SPECIAL ISSUE

RUN

THE HOME USER GUIDE TO COMMODORE COMPUTING

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1985

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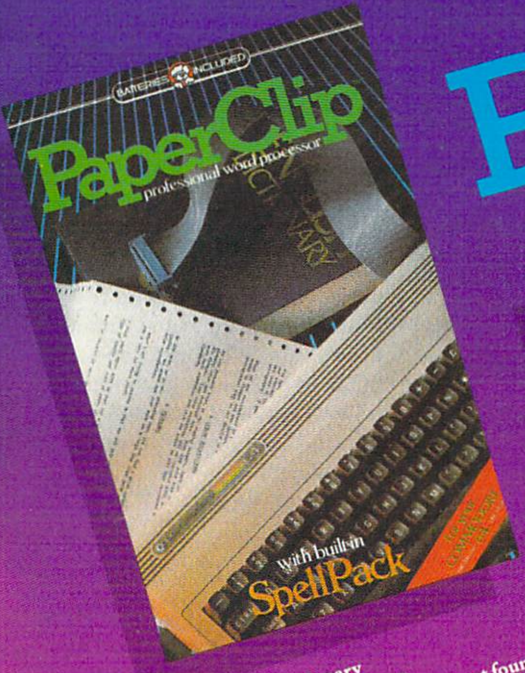
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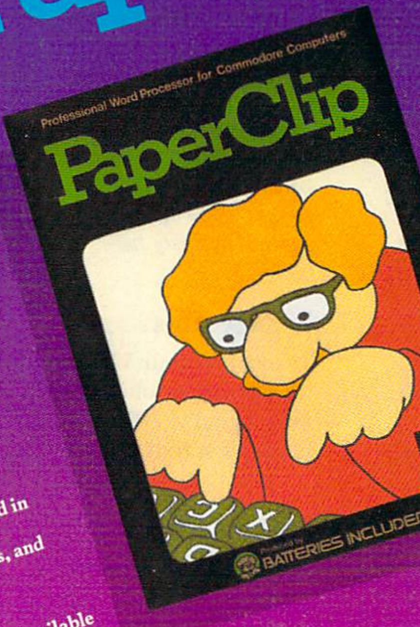
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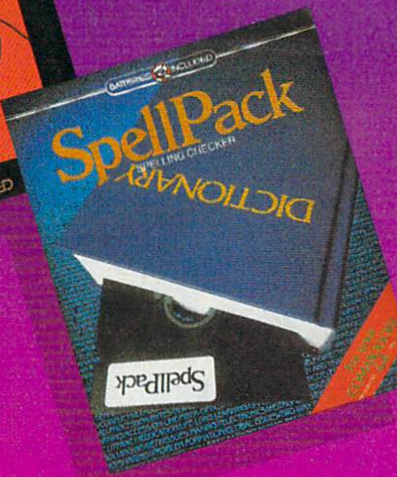
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A compilation of over 500 hints and tips—those published in *RUN*'s January through December issues, plus 150 additional entries for both beginning and experienced computerists. An index is also included. *By Louis F. Sander*

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Over 100 of the most frequently encountered computer terms defined. *By Mike Apsey*

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Poster Illustration by John Pirman

RUN is a member of the CW Communications/Inc. group, the world's largest publisher of computer-related information. The group publishes 52 computer publications in 19 major countries. Members of the group include: Argentina's *Computerworld/Argentina*; Asia's *The Asian Computerworld*; Australia's *Computerworld Australia, Australian Micro Computerworld, Australian PC World and Directories*; Brazil's *DataNews* and *MicroMundo*; China's *China Computerworld*; Denmark's *Computerworld/Danmark* and *MicroVerden*; Finland's *Mikro*; France's *Le Monde Informatique, Golden* (Apple) and *OPC* (IBM); Germany's *Computerwoche, Microcomputerwelt, PC Welt, Software Markt, CW Edition/Seminar, Computer Business* and *Commodore Magazine*; Italy's *Computerworld Italia*; Japan's *Computerworld Japan* and *Perso ComWorld*; Mexico's *Computerworld/Mexico* and *CompuMundo*; Netherland's *CW Benelux* and *Micro/Info*; Norway's *Computerworld Norge* and *MikroData*; Saudi Arabia's *Saudi Computerworld*; Spain's *Computerworld/Espana* and *MicroSistemas*; Sweden's *ComputerSweden, MikroDatorn, Min Hemdator* and *Svenska PC World*; the UK's *Computer Management, Computer News* and *Computer Business Europe*; the U.S.' *Computerworld, Hot CoCo, inCider, InfoWorld, MacWorld, Micro Marketworld, PC World, RUN, 73 Magazine* and *80 Micro*.

RUNNING RUMINATIONS

Lucky 13th

Whether you're a newcomer to computing or have been at it for several years, *RUN*'s special 13th issue promises to be a lucky one for you.

The editors of *RUN* have assembled, in this issue, some of the most valuable and useful information for VIC-20 and C-64 users that you'll find anywhere.

For example, be sure to find room on your wall by your computer to hang the free pullout wall poster found inside this issue. This visually attractive chart contains reference material that makes programming the C-64 and VIC-20 easier. It features Basic keywords and abbreviations, disk commands, ASCII codes, color codes, sprite information and convenient Peeks and Pokes—all the programming information you must constantly seek out in manuals.

Also, if you're like most *RUN* readers, your favorite section of the magazine is the Magic column. This special issue features over 500 computing hints and tips from *RUN* columnist Louis Sander, author of the popular Magic column. This collection will include every entry published in 1984, plus 150 new "tricks." The tricks are organized by topic—from disk tips to programming techniques and printers to sound and music—and a comprehensive index is included for ease of use.

Just getting started with your Commodore computer? Well, be sure to check out the section of introductory articles beginning on page 22. These will help you become acquainted with the principles and techniques involved in Basic programming, graphics, sound and music and telecommunications.

Sometimes, when you've learned all you can from books, magazines and special issues, you need to talk to other computerists. To find out who is available to lend an ear, we have included in this issue a complete, up-to-date list of Commodore clubs and user groups. You'll have a chance to share your experiences and questions with other Commodorists.

Another section of this special issue contains a comprehensive glossary of computer-related terms and expressions.

Well, there you have it—diversified, but useful, information in one easy-to-use reference guide. This special issue contains information of lasting value that you'll refer to again and again to help you get the most out of your computing system. As a matter of fact, we venture to say that there's enough information in this issue to keep the average computerist occupied through the coming year. . . until our next special issue. **db**

PUBLISHER'S NOTE

It is with great pleasure that we introduce you to the *RUN* Special Issue: 1985. We bring you this comprehensive handbook as something extra from *RUN*, designed for both new and experienced users of Commodore home computers. Our purpose is to publish a comprehensible handbook of information on Commodore computing which cannot be found elsewhere.

The *RUN* Special Issue will bring you the best of *RUN* and a wealth of new information to help you get the most out of your computer. If you're a newcomer, our handbook will serve you for many months as you begin your adventure in the world of Commodore computing, and if you're experienced, the handbook will provide more useful tips and information to increase your computing expertise.

With over 500 Magic Tricks, the Getting Started series, glossary, user-group listings and wall chart, *RUN*'s Special Issue will keep you busy for many months ahead. All in all, I believe the *RUN* Special Issue will make a valuable addition to your computing experience and knowledge, but most importantly, it will help make computing easier and more fun. We expect it will be a regular reference source for you, and will enhance your adventure in Commodore computing.

Stephen D. Twombly

HOW TO TYPE LISTINGS FROM RUN

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from *RUN* by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.

{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.

{SHIFT CLR}—hold down the shift key and press the CLR/HOME key at the same time.

{HOME}—press the CLR/HOME key without shifting.

{CTRL 6}—hold down the control key and press the 6 key.

{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).

{CRSR UP}{CRSR DN}{CRSR LF}{CRSR RT}—these are the four cursor directions.

{UP ARROW}—means the arrow key (the one with the pi sign under it).

{LB.}—the British pound sign (£).

{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

Print vs Print#

RUN readers should be aware of difficulties that may arise when entering listings that contain the PRINT and PRINT# commands.

These two commands may look very similar, but they are different. If, for example, you use a question mark (?) to abbreviate PRINT in a line such as 10 PRINT#4,A$, then you are signaling to the Commodore computer that you are trying to print the variable #4, which is not a legal variable name.

The command PRINT#4 actually means "print to device number 4." You can abbreviate PRINT# by hitting the P key and the shift and R keys at the same time and then entering the device number. But *do not* abbreviate PRINT# with a question mark.

If you think of PRINT as one command and PRINT# as an entirely different command with a different abbreviation, then you should have no problems.

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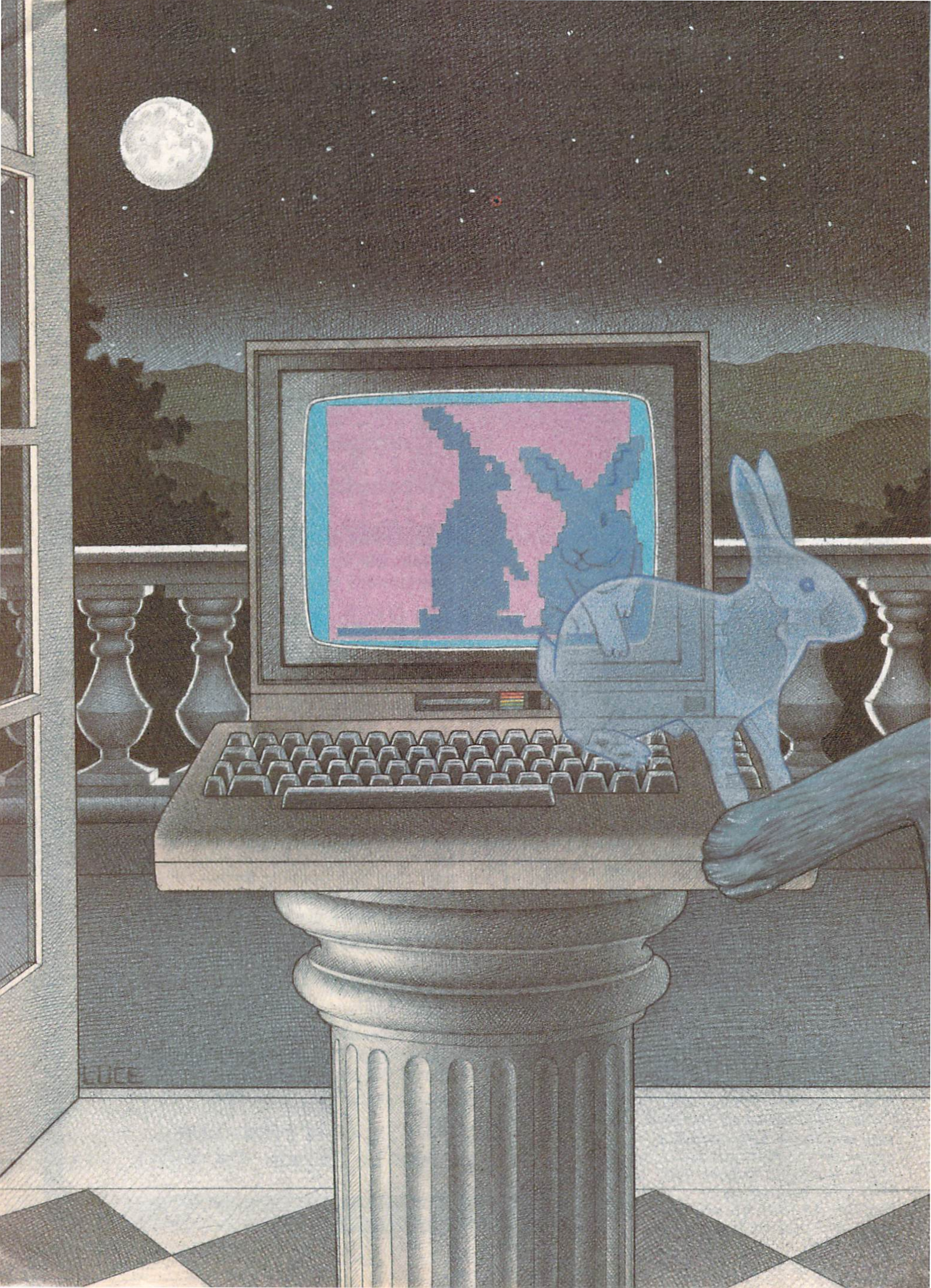

MAGIC

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MAGIC is a monthly column of hints, tricks and odds and ends from the worlds of software, hardware and applications.

Every month, MAGIC brings you brief and useful computer tricks from around the world—tricks that others have found to make computing easier, more enjoyable or more exciting.

MAGIC features simple hardware ideas, one-line programs, useful programming techniques, little-known computer facts and similar items of interest. We look for new or recycled material that is of current value to Commodore computerists and that can be implemented with a minimum of time, effort, or theoretical knowledge.

Send your own tricks and requests for a Trick writer's guide to:

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RUN will pay up to $50 for each original trick we print.

Compiled by Louis F. Sander

Illustration by Ben Luce

HARDWARE

CONNECTORS

CONNECTORS 1—When you attach external devices to your computer, you need special cables, which you can often make yourself *if* you have the right connectors. This trick identifies the connectors used on Commodore machines and gives specific information on finding them in stores.

The round connectors used for power, video monitor and disk/printer hookups are often called DIN connectors, after the German standards organization responsible for their design. DIN connectors are frequently used in audio equipment, especially that made in Europe, so connectors and patch cords can often be found in audio stores.

A good plug for the 5-pin audio/video monitor socket is the Radio Shack #274-003, available in any Radio Shack store. Six- and seven-pin DIN plugs for the disk/printer and power sockets are available at electronics parts stores carrying the Switchcraft PREH line of connectors. The 6-pin is Switchcraft #12BL6M, and the 7-pin is #15GM7M; current prices are in the $2.50 range.

The control port, which accepts a joystick or paddle controller, takes a standard female plug known as the DB-9, made by many manufacturers. The Radio Shack #276-1538 will fit this port, and the optional #276-1539 hood will give the connection a nicely finished appearance. Each part costs about $2.

The television connector on the Commodore 64 takes a very common plug known as a phono plug or an RCA plug. A variety of inexpensive phono plugs are stocked at Radio Shack, audio stores and wherever electronic parts are sold.

The cassette and user port connectors are called printed circuit board edge connectors. Edge connectors are made in a huge variety of types and grades, so finding the right one is like looking for a needle in a haystack. The ones for your Commodore are standard items for $^{1}/_{16}$-inch-thick pc boards, with contacts on .156-inch centers. The user port takes a 12-position dual-sided connector, while the cassette connector uses a 6-position single- or dual-sided connector.

Give those specs to your parts man. He can tell you what he has, which might include a variety of types in a price range from $2 to over $10. The cheaper connectors are fine for your purposes, and you'll probably want the kind with solder lugs rather than wire-wrap pins or other special terminals.

A good user port connector in the $2 price range is the TRW/Cinch #50-24SN-9 or equivalent; a similar connector for the cassette port is the TRW/Cinch #50-12SN-9. If possible, also get a polarizing key for each connector to keep it from being inserted upside down.

We couldn't find a source for expansion port connectors, which are male pc edge connectors. If you know of a source, tell us about it.

Victor H. Pitre
Pittsburgh, PA

CONNECTORS 2—Male pc edge connections for the expansion ports can be made from pc breadboards. For the VIC-20, Radio Shack breadboard 276-152, 44-pin, .156 spacing will fit perfectly.

For the 64, Vector makes a breadboard, 3719-1, which has 72 pins on .100-inch spacing and can be cut down to fit. Another source of expansion-port connectors is blown cartridges (see your dealer).

William C. LaRue
Boise, ID

EXPANSION CONNECTORS 1—Anyone skilled enough to make his own cables can easily make his own expansion port connectors. Radio Shack sells blank printed-circuit boards and all the equipment you need to etch your own, including the artwork for the male connector pins. It's easy and a lot of fun to make your own connectors in this way.

Clay Collins
Honolulu, HI

EXPANSION CONNECTORS 2—I have built circuits for the expansion port using Vector 3662DP plugboards. These are blank boards with $^{1}/_{10}$-inch spacing and 22 gold-plated contacts on each side. The cost is about $10. However, the numbers and letters used by Commodore on the expansion port are the reverse of industry standards (pin 1 standard is pin 22 on the expansion port, etc.), and this must be noted when wiring the connector.

Thomas Maggio
Rome, NY

EXPANSION CONNECTORS 3—Radio Shack stores carry two blank circuit boards that fit the VIC's expansion port: #276-152 or #276-154, each selling for under $4. The #276-1551 is a matching 44-pin, 22-position socket, and you can make a nice motherboard by mounting several of them on one of the blank boards.

If you don't have a local source for user port or cassette connectors, you can cut up a #276-1551 and make an acceptable substitute. Use a hacksaw, and carefully cut off a 12-position section from one end and a 6-position section from the other. Discard the extra 4-pin section, which will probably be rather hacked-up anyway. If you use care in inserting your new single-ended connectors, they can give good service until you locate something better.

Dick Halapin
Apollo, PA

DIN CONNECTORS—There are two points of caution when making up cables with DIN connectors.

First, the standard DIN pin numbers are not what you might imagine. Depending on the number of pins in the connector, for example, pin 1 may or may not be next to pin 2. The situation is so confusing that even published diagrams are sometimes incorrect. (The ones in Commodore publications are all right. Look closely at them to see what we're talking about.)

A STEP BEYOND.

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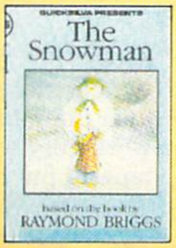
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The second confusing point is that published pinouts often don't say which end of which sex connector they are illustrating, so it's again unclear which pin is which. The Commodore manuals illustrate the solder terminal end of the male connector.

Tiny pin numbers are always molded into the insulator, so if your eyes are good and if you're careful, you shouldn't have any trouble.

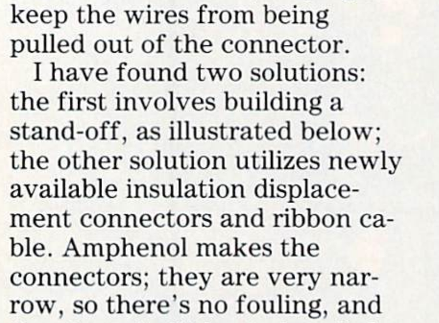
L.F.S.

CONNECTOR HOODS—There's a minor problem in using a hood on a control port connector. . .the edges of the hood may prevent the connector from being pushed all the way into the port, and will also interfere with any connector in the other control port.

Trimming the edges means that the hood won't be held securely to the connector, and not using a hood at all is bad practice because of the possibility of shorting the exposed contacts. Furthermore, the hood acts as a form of strain relief, helping to keep the wires from being pulled out of the connector.

I have found two solutions: the first involves building a stand-off, as illustrated below; the other solution utilizes newly available insulation displacement connectors and ribbon cable. Amphenol makes the connectors; they are very narrow, so there's no fouling, and they have built-in strain reliefs and don't need to be soldered.

For expansion port connectors, I previously used a Radio Shack pc board, which had 50 edge connectors on each end. I cut them down to 44 fingers with a small X-Acto knife. Unfortunately, this item has been discontinued, so now I've been etching my own, using Radio Shack's direct-etch dry transfers (276-1577) and double-sided copper-clad board. It's fast, easy and a lot cheaper.



THE WIRE IS A SNUG FIT INTO THE SOLDER CUPS ON THE CONNECTORS. I THEN USED LIQUID RUBBER (AVAILABLE FROM PLASTIC SHOPS) TO SURROUND THE WIRES CONNECTING THE SOCKET AND PLUG.

John Kula
Victoria, British Columbia
Canada

DATASSETTE RECORDING

SAVE THAT DATASSETTE!—When you finally get a disk drive, don't put your Datassette in the closet. Make backup copies of your important programs on tape, so you won't be out of business if your disk drive gets sick.

One C-60 or C-90 cassette will hold a lot of programs, and by using the tape counter to make an index, you can make them easy to find.

R.V. Taylor
Little Rock, AR

SAFETY TIP—My cat jumped onto the computer table, knocking the braid from the Datassette connector inside one of the rear ports, where it did a lot of electrical damage. To prevent such accidents in the future, I made covers for all the ports by folding pieces of duct tape nearly in half, lengthwise. I used the remaining sticky part to fasten the covers to the rear of my computer, where they can be lifted up when access is required. My covers keep paper clips, cable braid, dust and other unwelcome items outside the computer, where they belong.

Lorraine Richards-May
Leesburg, IN

Editor's note: Those Datassette braids are much more trouble than they're worth. Since they are only used with Commodore PETs, many VIC and C-64 owners just cut them off and discard them.

LOW-COST CASSETTES—I never pay more than 40 cents for a computer tape. Mail-order companies offer short tapes (C-5 to C-20) in this price range, as long as you buy two dozen or so at a time. If you don't need that many, find a friend to buy the extras. For the C-30 and C-60 lengths, I buy audio tapes on sale at discount stores. Low-noise tapes are often available in my area at three for a dollar. As long as the tapes have the five-screw construction, they seem to work fine. If I do find a problem with a given tape, I simply rewind it and use the other side.

Frank Colosimo
Rochester, NY

CASSETTE TAPES—Always use C-5, C-10 or C-20 cassette tapes for your computer programs. These short tapes are especially made for computers, and if you lose the tape, damage it, or expose it to something magnetic, you won't be losing as many programs as you would if you used 30-, 60- or 90-minute cassettes.

Greg Osysko
Palatine, IL

LABELING TAPES—Use strips of Scotch Magic Tape to label your cassettes; they take pencil marks very well and can be easily erased. But be careful to keep the eraser crumbs out of the tape and the tape deck.

L.F.S.

CASSETTE BOXES—Store your program tapes in Radio Shack #44-608 soft plastic cassette mailers. They are tougher and less expensive than the hard plastic boxes.

Hashafisti Scratchi

CASSETTE STORAGE—Buy one or more cassette caddies to store your library of tapes. Radio Shack has many different styles of caddies, most of them under $5. Discount stores have an even larger variety, usually in the same price range.

John Box
Glencoe, IL

CASSETTE LABELS—Every stationery store sells $^{5}/_{8}$- × 3½-inch file-folder labels, which work very well with Datassette tapes. I put one on each side of my cassettes and on the edge of my hard plastic storage boxes. The labels are available in white

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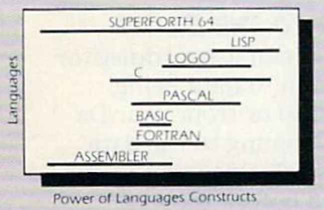

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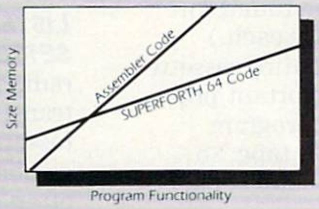

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Maureen Swanson
Kitimat, British Columbia
Canada

Tape Write Enable—If you have Poked out the write-protect tab on a cassette, there are two ways you can override the protection. One is to put tape over the hole that you punched out. The other is to fool your Datassette into thinking the hole has been covered.

Open the Datassette cover and locate the small pin that fits into the empty hole. (It's way in the back, far to the left.) Then gently push the pin toward the back of the recorder and press the record button. Insert your tape and hold the record button down again as you press the play button.

The PET Gazette

Cassette Write Protection—I break out the write-protect tab on all my cassettes, to prevent accidental writing in the wrong place. To defeat the write protection, I've made a loop from a half-inch-wide strip of cardboard. The loop is just the right size to fit around a cassette and cover the write-protect hole, and I've colored it red with a marker.

When I want to write to a tape, I make sure it is wound to the correct position, then I slip the red loop over the left side of the cassette. The red warns me that the tape can be written on, and the loop overrides the write protection.

Fred R. Todd, Jr.
New Orleans, LA

Write Protection—The write-protect tabs used on disks make ideal write-enable tabs for cassettes! After you've broken the tab out of a cassette, you must tape over the hole before recording on it again. The disk tabs are just the right size for the job, and a sheet of them comes with every box of disks. Ask a disk-owning friend to let you have some.

L.F.S.

Tape Library Hint—Saving different types of programs on the same tape can lead to a lot of searching for the right tape and program. Try saving one type of program on one tape, and a different type on another tape. For example, reserve one tape for games and another for home-financial programs. This technique will help you find and load your programs much faster.

Stephen Morse
Northfield, MA

Cassette Library Hint—Finding programs on tape can be a chore, but this trick will make it a lot easier.

Buy as many cassettes as you have frequently used programs. (Tapes can often be found for far less than a dollar each.) Then dedicate an entire cassette to each of your important programs. Record the program twice or more on its tape, so you have ready backup copies in case of disaster.

Write the name of the program on a narrow label on the edge of each cassette, and store your tapes in a plastic storage unit, label facing out. Keep your tapes rewound at all times.

With a tape library set up like this, it takes only seconds to grab the program you want; in seconds more, it can be loading into your computer.

Frank Colosimo
Rochester, NY

Cassette Handling—If you keep an index of the tape-counter numbers where each program starts, you can fast-forward to the proper place, before executing the Load command, and load your programs with a minimum of search time.

To make the index, rewind your tape, then press the button that sets the tape counter to 0. Enter VERIFY"ZZZZZ" (or some other nonexistent program name), then watch for the computer to find each program. Record the numbers that appear on the counter at the instant each program is reported found. Since the program actually starts about four to five counts before FOUND appears on the screen, subtract 4 or 5 from each number. Then record your numbers on a card or in a notebook, and you'll always know where to find each program on the tape.

Alternatively, you can make your index as the programs are recorded. Be sure your counter is set at 0 when the tape is rewound, then start to record. Write down the counter reading when you press the Play and Record buttons for each program, then transfer the readings to your notebook. Since you are making direct readings of the starting points, you needn't do any subtraction.

Don Turnpaugh, Jr.
Greentown, IN

Listening to the Datassette—You can use a transistor radio to listen to data being transferred to or from your Datassette. Listening to the data can be helpful, since errors are often heard before they're seen.

Tune your radio to a clear channel and place it just behind the 3,4 and 5 keys on your machine. Then save a program, and you should be able to hear the data transfer. Move and tune the radio to find the conditions for the strongest signal.

This trick works because the rapid switching of computer circuits creates low-power radio interference that can be picked up by a nearby receiver.

Randall Lipham
Eaton Park, FL

Cassette Load Alarm—You can make your computer execute one line of Direct mode code when it's finished loading a program. Just follow these steps:

- Clear the screen and type in your Direct mode code, making sure you are on the first line of the screen.
- Do *not* press the return key at the end of the line; do a *shifted* return instead.
- Type in your Load command, then press the return key.
- Before pressing Play, press the home and return keys, in that order.

- When the program has been loaded, your line of code will be executed automatically.

The following line of code will give an audio tone on the C-64, so you'll know that the program has been loaded.

```
POKE54296,15 : POKE54278,240 :
POKE54273,50 : POKE54276,33
```

Sheldon Luberoff
Centereach, NY

CASSETTE ML LOADING—Most of us know that to load machine language from cassette, we must use the LOAD"name",1,1 format, with the name optional. The second "1" tells the computer to load the program into the address range from which it was originally saved. But lots of us *don't* know that there's a case where the second 1 can be omitted. Tapes made using the form SAVE"name",1,1 will *always* load back into their original addresses, regardless of the Load command that is used.

William King
Detroit, MI

LOADING FROM PROGRAM MODE—When one Commodore program loads another, the second must be shorter than the first, or great confusion ensues. (The purpose of this restriction is to allow the second program to use variables that have been set up by the first one.)

If you're loading from tape, you can get around the restriction by entering:

```
600 POKE631,131:POKE198,1:END
```

This has the same effect as pressing the shifted run/stop key.

Geoff Shukin
Saskatoon, Saskatchewan
Canada

TAPE LOAD TIMESAVER—As many of us know, programs are recorded twice on each cassette, following a 15-second header. The dual-recording scheme is used for error correction, but if there are no errors, the whole program is in memory as soon as the first copy of the program has been read.

You can use this fact to your advantage in shortening the time it takes to load a program. To cut loading time almost in half, use the following line before you use any variables in your program.

```
10 POKE 45,PEEK(831) : POKE 46,
   PEEK(832) : CLR
```

Now when you are loading the program, press the computer's stop key any time after the header and the first program copy have loaded, then run the program normally. Line 10 will compensate for your failure to load the second copy. The proper stopping point is just over half way between the Found and Ready prompts. You can use the tape counter to find this point once for each program; then write it on the cassette for future reference.

Derek Richards
Papakura, New Zealand

CASSETTE ERROR HINT—If you experience numerous errors when saving, verifying or loading with the Datassette, a possible cause might be conflict with the C-64 DOS wedge program.

If you're using that program with a disk drive, enter @Q before using the Datassette. This command turns off the wedge program and may clear up your errors. To re-energize the wedge, enter SYS52224, then type @#8 [return].

Other problems with Datassette errors can usually be eliminated by cleaning and demagnetizing your recorder heads, and/or by using a bulk eraser on your cassettes.

Adam Szymczak
Brantford, Ontario
Canada

CASSETTE LOADING—If you are getting numerous Load errors when trying to load a tape, try moving the Datassette farther away from the computer and monitor. This may put an end to your troubles.

Richard D. Bailey
Bronx, NY

OVERCOMING LOAD ERRORS—It's not necessarily fatal when a Datassette load terminates with a ?LOAD ERROR message. There are two copies of the program on every tape, and the error message arises when the computer compares them and finds them different, even if the copy it loads into memory is perfectly good.

So when you get a Load error, try this: List the program in memory to see that it's a good copy (if it's bad, the problem is usually *very* obvious); then, in Direct mode, type:

```
POKE45,PEEK(831):POKE46,
PEEK(832):CLR
```

Chances are excellent that your program will run perfectly.

Thomas Schuster
Staufenberg, West Germany

TAPE LEADER—There is no need to advance your cassettes past the plastic leader before doing a Save. Commodore computers start every Save by recording ten seconds of programless leader tone, allowing plenty of time for the magnetic part of the tape to appear in front of the record head.

Thomas McClary
Hollywood, CA

CASSETTE TAPE INDEX—When saving the first program on a new cassette, consider reserving space for a tape index, which you can record at the start of the tape after it is full. Ten numbers on the tape counter should be enough to hold a very large index, especially if it's a simple one. My indexes are disguised as Basic programs, with the line numbers corresponding to tape-counter settings, and with the program names typed in as Basic text. The following example will save, load and list perfectly, but of course it can't be run.

```
0 INDEX
10 PROGRAM #1
20 PROGRAM #2
45 PROGRAM #3
55 Etc., etc.
90 END OF LAST PROGRAM
```

Ken Wills
Pittsburgh, PA

TAPE COUNTER 1—It is advantageous to leave a space of about ten counts between programs on your tape. This way, you can add something to any program without having it over-write the program that follows it on the tape.

A. Lubin
Monsey, NY

TAPE COUNTER 2—When using a cassette drive with a digital tape counter, save your programs on a series of numbers, such as 10,50,100,150,200 and so on. If you ever lose your card of programs, all you'll have to do is load at these popular numbers to tell what programs are on the tape.

Brian R. Barnholtz
Winona, MN

TAPE SAVE TIP—To save time when making more than one copy of a program, try this: Clear the screen, then execute the Save and Verify commands as usual, with the Verify command on the line immediately below the word READY after saving.

For successive copies, place the cursor over the initial Save command, then press CTRL and a color that is different from the one printed on the screen. When you press the return key, the PRESS RECORD. . .prompt will change to the new color. When the save is complete, READY will change to the new color, and the cursor will appear on the Verify command, again in the new color. Now rewind and press the return key; your program will verify with no futher typing.

An occasional glance, even from across the room, will tell you whether your computer is saving, verifying, or if it needs your attention. The same technique can be used for loading and saving a series of programs on the same tape.

Marie E. Coon
Bothell, WA

BASIC/MACHINE LANGUAGE CASSETTE SAVES—Basic programs often incorporate short machine language subroutines that are saved in the cassette buffer. This usually requires a routine in the Basic program to Poke the machine language subroutine into the buffer. A simple trick lets you save memory by omitting the Poke routine and saving the entire program together on tape (machine language subroutine and Basic). To use it, just put your machine language somewhere in the range 849–1019 decimal, then execute the following Direct mode line:

```
A$ = "" : FOR N = 849 TO 1019 :
A$ = A$ – CHR$(PEEK(N)): NEXT
```

When you get the Ready prompt, execute:

```
SAVE "program name            " + A$
```

There must be exactly 16 letters and spaces between the quotes, or the subroutine will not load properly. Also note that the starting address of the subroutine *cannot* be the customary 828 decimal, but must be 21 bytes above it.

Alan P. Davenport
Salem, OR

SAVING DATA—For those who've never saved anything but programs on their Datassette, here's a little program that illustrates the saving of data.

```
10 PRINT"{SHFT CLR} INPUT DATA";
   :POKE631,34:POKE198,1:INPUTD$:
   PRINTD$
20 OPEN1,1,1,"DATA":PRINT#1,
   CHR$(34) + D$:CLOSE1
30 PRINT"{SHFT CLR} REWIND
   TAPE, THEN PRESS A KEY."
40 GET A$:IF A$ = ""THEN 40
50 OPEN1,1,0,"DATA":INPUT#1,D$:
   PRINTD$
```

The Pokes in line 10 put a quotation mark as the first character in D$, allowing it to contain commas, colons and so on. When the quotation mark is read back, it places the computer in Quote mode, so all the characters will be printed as they were typed.

Kenneth E. Stringham, Jr.
Attleboro, MA

NAMING TAPE PROGRAMS 1—When saving a program on tape, add the RVS to your program name. Then when you read it back, it will print the name on a white background, making it easy to spot. Just type SAVE "[rvs on] PROGRAM NAME [rvs off]" [return].

The PET Gazette

NAMING TAPE PROGRAM 2—I had written a machine language program for my wife, who is not a computer user. I wanted the loading of the program from tape and the running of the program to be as easy as possible.

The solution was to put the program at the beginning of a tape (of course) and to name it with the "SYSxxxxx" command preceded by one CRSR DN, followed by three CRSR UPs. This way, all you have to do is type in LOAD. Then, after the program is loaded, pressing the return key will start the execution.

For example, working from a machine-language monitor, if I were to save a program from $C000 to $C14A, I would issue this Save command in the monitor:

```
.S "{CRSR DN}SYS49152{3 CRSR UPs}"
,01,C000,C14A
```

If you're working with a disk, this technique obviously gets fairly complicated, since the Load command would have to include the full name with the cursor commands. But for tape, it works well.

Steven Kinsel
Pittsburgh, PA

NAMING TAPE PROGRAMS 3—When you search through a cassette using the Verify command, and try to find a certain program or data file, you're unable to differentiate between them because the computer displays each on the screen in the same way. This makes it impossible to know which are programs and which are files.

One solution is to save programs as before, but to write data files with titles in reverse characters. For example:

```
OPEN 1,1,1,"(RVS ON) name of file"
```

Then, when you search through a cassette, program names are in normal type and data files are in reverse characters.

Jim E. Newton
Mississippi State, MS

NAMING TAPE PROGRAMS 4—You can make your program lock the computer into lowercase mode by saving it on tape as follows:

```
A$ = CHR$(14) + CHR$(8) + "program
name" : SAVE A$
```

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Replacing the 14 with a 142 will lock the computer into the Graphics mode. Deleting the CHR$(8) will put the computer into either mode, but the user will be able to switch modes by using the shift and Commodore keys.

E.L. Hayno
Pensacola, FL

NAMING TAPE PROGRAMS 5—Do you want to add a little color to the name of your program? When you save it, make one or more color keys part of the program's name. For example:

```
SAVE "[rvs][grn]N[red]A[pur]M[blu]E"
```

Each color key counts as one of the name's 16 maximum characters.

Joan S. Paik
New York, NY

CASSETTE DIRECTORY—To get a list of all the programs on a tape, enter LOAD"X*X*X" (or some similar bizarre name). As long as the string is not the name of anything on your tape, the computer will search for it forever, printing out the name of each program it finds on the way.

David Lonard
Edinburg, TX

DATASSETTE TRICKERY—If you want to save something onto a cassette but you're not sure if something valuable is already there, rewind the tape and use the Verify command. The computer will tell you what's on the tape, and the program in memory will not be disturbed.

Unsigned

ERASING TAPES—If you use a Datassette, you will have many tapes full of programs you no longer need. It is best to erase these tapes before using them again, since failure to do so tends to promote Load errors. One way to erase a tape is to use a bulk eraser, available at audio stores for a few dollars up to about $25.

Another way to erase a tape is by putting it into your Datassette and running it with the Record and Play buttons depressed. As long as you haven't executed a Save command, no signal will be going to the tape drive, so the old data will be erased.

David Courtney
Worcester, MA

DATASSETTE DEBUGGING—If you try to save a C-64 program on tape, and the recorder runs continuously without saving your program, try entering POKE0,47.

You may have inadvertently disrupted location 0, the data direction register, by Poking an uninitialized variable. (All numerical variables default to 0 until another value is assigned.) Normally, bit 3 (cassette write line) of location 0 is set to 1, but making an inadvertent Poke can clear it, causing your recorder to run without recording.

Denis A. Bryan
New Orleans, LA

CASSETTE DUPLICATION—Duplicating cassette-based programs by loading and resaving them is a time-consuming and unrewarding job. It can often be made easier if you use standard audio methods to duplicate the tape. If you have an audio cassette deck that lets you copy tapes, try it on your computer tapes. The odds are high that it will work fine, but you might have to experiment with different recording levels. By cranking up the playback volume while recording, you can hear when your copy is finished.

Many colleges also have coin-operated cassette-duplicating machines, which work even faster than home-audio methods.

While your tapes are being copied, you can use your computer for other things.

Armand M. Diagneault
Inglewood, CA

DATASSETTE SWITCH SENSING 1—When using the Datassette to handle files, you should always press its Stop button whenever a read or write operation is finished. If you fail to do so, the Record button is likely to be in the wrong position for the next operation. Since a button will be down when that operation is started, you'll get no screen message reminding you to press the proper switches.

Memory location 192 contains a zero whenever all Datassette switches are up, and contains nonzero at all other times. I have my data-handling programs monitor location 192 at the end of any I/O operation, printing a warning message if I've failed to press the Stop button. Typically, the code looks like this:

```
100 OPEN1,1,0,"FILENAME"
110 etc.
120 etc.
200 CLOSE1
210 PRINT "PRESS STOP SWITCH!"
220 IF PEEK(192) THEN 220
230 Program continues here
```

Line 220 will not allow the program to continue until I've turned off my recorder.

Paul Howe
Santa Cruz, CA

DATASSETTE SWITCH SENSING 2—On the VIC, location 37137 holds a 62 whenever any button on the Datassette is depressed. I have my programs look at 37137 after any tape operation, and remind me to press the Stop button if it contains a 62.

Kenneth Hart
Harker Heights, TX

DISK RECORDING

DISK BUYER'S GUIDE—When buying floppy disks, look at the exposed part of the disk around the center hole. Quality disks have a clear or colored reinforcement ring in this area, to protect them from wear caused by the disk drive. Disks without the protective ring might not last as long.

Russell P. Marsella
Lincoln, RI

SELECTING DISKS—Commodore disk drives specify the use of soft sectored disks, which are the type with a single index hole punched into the magnetic media. In reality, Commodore drives don't use the disk index hole at all, so they'll work with hard sectored (many-holed) disks as well.

Paul Aitkenhead
Perrysville, PA

DISK HINT—If a floppy disk has been exposed to cold temperatures for any length of time, it must be allowed to slowly warm to room temperature. If you record on a cold disk, you may not be able to read it when it is warm. A prerecorded disk may also cause problems when cold. Always allow your disks to warm slowly to room temperature, never using any sort of artificial heat source. You should use similar precautions with disks that have become overly hot for some reason.

Tom Skantar
Pleasant Unity, PA

DISK CARE—To help prevent damage to your disks (dust, smoke, spills, etc.), store them individually in Ziplock sandwich bags. These bags are waterproof and transparent, and their small cost is well worth the protection they give.

Ed Moore
Portland, ME

DISK STORAGE—K-Mart and other stores have a $2 plastic 8-track tape storage box that nicely holds up to 60 disks. The box has a 4½- × 12-inch opening, and two rows of disks will fit perfectly if they are inserted crosswise to the direction intended for the 8-track tapes. There's also a plastic lid to keep the dust out. The K-Mart stock number for the box is C-12 or XC-12, and it's made by Soho Corp., PO Box 20081, Ferndale, MI 48220. If you can't find the box in your local store, ask the manager to get it for you. If that fails, write to Soho and ask for the name of a local dealer (they don't sell to consumers).

Tom Reigle
Shattuc, IL

DISK STORAGE TIP—I keep my disks in the plastic picnic cooler called Little Playmate, made by a company called Igloo. It is available for about $10 in most discount stores, and holds 50 disks with ease. The best part is that the case has a locking top and a carrying handle, so I can transport my disks without fear of damage. Since it is an insulated cooler, the disks won't overheat, either.

Mariano A. Rivera
Maitland, FL

DISK FLIPPING—It is possible to use both sides of a disk, if you're willing to cut a new write-protect notch and to take a few chances with reliability. Disk drives read the bottom side of the disk (the unlabeled side), and disk manufacturers test and guarantee the quality of the magnetic coating on that side.

The top side of the disk is also coated with magnetic material, and even though it isn't guaranteed or tested, in many cases it works perfectly well. The only thing that prevents you from using it is the absence of a write-protect notch in the proper place. If you cut one with a razor blade or sharp scissors, *voila!*—you have a flippable floppy disk. It's good to use a second disk, flipped over, as a template for cutting the notch. The new notch goes just opposite the old, in the area where the manufacturer's label is usually placed. To use the top side of the newly-notched disk, just insert it upside down into your drive (oval read-slot first, manufacturer's label downward).

There *are* some dangers. It's possible that your new disk surface has some flaws in it, and if it does, it's likely that you'll lose some data. Also, flipping a disk changes its direction of rotation with respect to the jacket, possibly releasing some of the contaminants the jacket has scrubbed from the magnetic surface.

Disk manufacturers advance these and other reasons against flipping disks. Computerists often successfully disregard them. It's up to you to decide whether the saving is worth the risk, and to act accordingly. When you dabble in magic, you also dabble in *danger*!

David William Vernham
Michigan State University

DISK DIRECTORY—It's very useful to tape a printed copy of the directory to the disk's protective envelope. The following sequence will print it.

```
LOAD"$",8:
OPEN4,4:CMD4:LIST
```

When the printing is done, enter this to clear the printer:

```
PRINT#4:CLOSE4
```

Remember, ?# is *not* an acceptable abbreviation for PRINT#—if you use abbreviations, the proper one is P shift R.

Travis Stansbury
Oakridge, OR

WORKING DISKS—Designate a couple of disks just for programming. Do all your program entry and editing on these disks, and when you have a final version, save it onto another disk. This saves wear and tear on your good disks, and prevents you from overwriting or clobbering other programs by mistake. When your working disks are full, reformat them and use them again.

Mike Martin
Phoenix, AZ

DISK LIBRARY TIPS—Format a disk called Utilities, and use it to save all the helpful tricks and subroutines you find in *RUN* and elsewhere. Be sure to include a merge or append program, so you can add these tools to your other programs. If you name the subroutines by their purpose, it is easier to work with them.

Michael Conley
Bell, CA

DISK LIBRARY HINT—As an aid in keeping disk files in order, use 5- × 8-inch file cards cut to 6 inches and slipped behind the disk in the envelope. Put the disk name and I.D. number on the protruding top of the card, and tape a copy of the directory to it. It's also convenient to use a product called Pres-A-Ply consecutive numbers from Dennison. They are numbered consecutively from 0 to 100, and make a neat I.D. label when affixed to the disk itself.

Alex J. Molchin
San Jose, CA

DISK OF DIRECTORIES—Your Commodore loads and saves disk directories just as if they were Basic programs. With this in mind, you can create a directory for your disk directories. Just format a disk with the name Directory or something similar. Then load a directory from one of your disks (I'll call that disk WXYZ), using LOAD"$",8 rather than the wedge. Next, save it to the Directory disk using a filename that is the same as the name of the disk it came from.

Repeat the procedure for the rest of your disks, and you'll have a handy master directory. When you want to see what's on the WXYZ disk, put the Directory disk into your drive, then type LOAD"WXYZ",8. When you list it, you'll see that it's really the directory from disk WXYZ.

Stephen Chong
Stillwater, NJ

DISK SPACE—Attempting to use all the space on your disk is counterproductive. Leave up to 20 percent of each disk free, to allow for later modifications to your programs or expansion of your data. This will prevent splitting programs or databases between disks, or having to resave an entire program onto a second disk.

Frank Tymon
Lancaster, CA

DISK DRIVE STILTS—You can keep your disk drive running cool by sawing through four new pencils about two inches from the eraser and placing the cut ends into the screw holes on the bottom of the drive. The eraser ends rest against your table and raise the drive high enough to help keep it cool.

Jerome Beck
Glendora, CA

DISK COOLING TOWER—To minimize overheating of our disk drive, we spent 15¢ for a 24- × 30-inch piece of poster paper, then folded it into a 4- × 8-inch tube, 24 inches long. This marvelous device now stands over the vents in the top of our 1541, where it acts as a chimney to draw air through the drive. Since we started using it, we've never had a problem with overheating.

Lou Hinshaw
Tulsa, OK

DISK COOLER—Last summer I was concerned by the high temperature of my disk drive. My wife, Barbara, took our Norelco Clean Air Machine and set it on the drive directly over the vents. Its fan pulls air in from the bottom, simultaneously cooling the drive and taking the static and dust out of the air. Its effectiveness can be improved even more by wrapping a piece of masking tape around its legs, forcing more of the air to flow through the 1541.

Allen R. Mulvey
Fulton, NY

DISK OVERHEAT FIX—If your disk drive tends to overheat severely, try loosening its cover. Remove the four screws at the bottom and lift up the rear portion of the cover before plugging in the serial cables. The cables will hold open the top and add increased ventilation.

Tom Hoppe
Spokane, WA

1541 HEAD CLEANING—Some commercial head-cleaning disks require 20–30 seconds of operation with the red light on to get good results. The following simple program will accomplish that result:

```
10 OPEN 15,8,15
20 PRINT #15,"I"
30 INPUT#15,A,B$,C,D
40 N = N + 1 : IF N < 15 THEN 20
```

The key point of the program is that line 20 gives an error that is rapidly read and cleared in line 30. The loop in line 40 allows the program to repeat for about 20 seconds of drive operation.

Cesar Ovalles
College Station, TX

DISK HANDLING TIP—Have you ever opened the door of your disk drive, only to find that the disk doesn't pop out where you can reach it? To remove the disk quickly and safely, use an alligator clip as tweezers. It doesn't put too much pressure on the disk, and it can't be inserted far enough to do damage to the drive.

Douglas L. Wilkerson
Pekin, IL

RED LIGHT—Nothing in the Commodore 1541 disk drive documentation tells you not to worry if the red error LED stays on after the drive has stopped running. The fact is, it indicates an open file, and it will turn off if and when you close all your files.

Richard Mitchell
Lafayette, LA

AUTOMATIC FILE CLOSER—When a program involves working with disk files, an error can sometimes leave files open by mistake. The indication for this is an illuminated red LED after the program has run its course. Failing to close the file at this point can corrupt it on the disk, so discretion says it *must* be closed. The following simple line will do the job.

```
OPEN 15,8,15 : CLOSE15
```

Maria Reichmanis
N. Augusta, SC

DISK ERROR DETECTION—If the red LED on your disk drive starts flashing, some sort of disk error has occurred, and you can easily tell which error it is. While the light is flashing, add the following line to your program.

```
0 OPEN15,8,15:INPUT#15,A,B$:
  PRINTA,B$:CLOSE15:END
```

Then run the program. The LED will go out and the error number will appear on the screen.

Complete explanations of each error number appear on pp. 43–46 of your *1541 User's Manual.* By the way, this method won't work in Direct mode, since the Input# command can only be used from inside a program.

Robert A. Adler
Montreal, Quebec

1541 DRIVE PROTECTOR—This trick will reduce the chance of head alignment problems with your 1541. When using commercial programs that involve a lot of access to the disk drive, it's possible to leave the head out of

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position at the end of a session. You'll only find out about it when you repower the drive and hear the loud clacking of the head as it centers itself. (Too much of that clacking is what gets heads out of line.) To avoid the problem, just call up the disk directory (LOAD"$",8) at the end of your session. Calling the directory centers the heads.

John Charbonneau
Salem, NH

DISK DRIVE CRASH TEST—The 1541 disk drive has a habit of occasionally locking up in the middle of an operation. When you are loading or saving a long program, you often don't know if the operation is still going on, or if your system has locked up. To check if the operation is still going on, press the shift/Commodore combination a few times and watch the screen. If the characters shift between upper- and lowercase, the operation is still going on.

Don't expect the shift to occur every time, as the computer is working with the disk *and* reading the keyboard. But if the shift doesn't occur after several tries, you can assume the disk is locked up and you should restart your system.

Jonathan Entner
Malvern, PA

DISK CRASH FIX—On those occasions when some messed-up I/O operation causes the 1541 to become "Not Present," you can often regain its attention with POKE144,0 on both the VIC and the C-64. Location 144 holds the Status word (ST), and clearing it usually clears up the disk problem as well.

Charles Lavin
Coral Gables, FL

TRANQUILITY TIP—On a few occasions, I've put my disk in the drive and it read that I had lost my directory. Feeling angry, I reformatted the disk. I later found out that there was just some dust or dirt on the drive head, and that I had needlessly killed all the programs on my disk. I advise anybody who has a similar symptom to boot the system over again and give it another try. If this doesn't work, clean your disk drive.

Michael DeLuise
Washington, VA

DISK LOADING TIP—If you have a Datassette on your VIC or C-64, you probably know you can type shifted Run/Stop to load and run the next program on the tape. Disk users, believe it or not, can take advantage of this, too. Type (don't hit Return yet):

```
LOAD"program name",8:
```

Now press shifted Run/Stop, and the computer will load your program and automatically run it!

Marcus Featherston
Fairdealing, MO

EASY DISK LOADS—Loading a program from the 1541 disk drive can be made simpler in many cases by using the program's directory entry. List the directory to the screen, then move your cursor to the desired program. Type in an abbreviated Load command (L shift O) and a comma, 8, obliterate PRG, then press the return key. Your program will load immediately. Here is a sample directory load.

```
L(shifted O) "Filename",8,1:
(return) PRG
```

If the program is in machine language and you use a nonrelocating secondary command, the following example avoids a syntax error.

```
L(shifted O) "Filename",8,1
(return) PRG
```

If the program is in Basic, use the following example to avoid a syntax error and having to space over the PRG.

```
L(shifted O) "Filename",8: (return) PRG
```

Chris Johnson
Clearbrook, British Columbia
Canada

TEMPORARY PROGRAM NAMES 1—When you write a long program, it's a good idea to use a short name on the disk until you finish the program. It's faster and easier to type in a short program name. You can rename it after you finish the program.

Jimmy Burrows
Cheyenne, OK

TEMPORARY PROGRAM NAMES 2—When I'm developing a program, I have a habit of saving my work to disk every ten minutes or so. This habit has saved me many hours of work when the machine locked up or lost power in the middle of typing a long program. When making these safety saves, however, the disk can get full of partial programs that have no value once the main program is finished and a final copy is saved.

My trick is to name the safety programs according to the number of the last line they contain. A program with lines 10-140 would be named "–140", one whose last line is 2000 would be "–2000" and so on. The nice part comes when I want to scratch the safety programs. I just use S0: – * which kills them all at once.

Daniel H. Sealy
Hammond, OR

NAMING DISK PROGRAMS—Place your most-used program first on your disk, where it can be loaded by LOAD"*",8. This is easy and quick to key. Also, build each disk with a purpose, e.g., Basic utilities, word processing or games, tailored to your own interests.

Thomas Harney
Ilion, NY

EASY-LOAD NAMES 1—I have gone through all my disks and renamed the programs to begin with a letter, number or symbol. I've done it in such a way that only one program name per disk begins with any given character. Then I listed all my directories to the printer and filed them in a three-ring binder. Now I can glance through the book, choose a disk and program, then load it by typing:

```
LOAD"(first character of name)*",8
```

This is even simpler when using the wedge, because of that program's easy Load commands. For readers who are uncertain, here's how to rename a program:

```
OPEN15,8,15,"R0:newname = old
name":CLOSE15
```

(where newname and oldname stand for the actual names you're working with). Here's a

Continued on p. 108.

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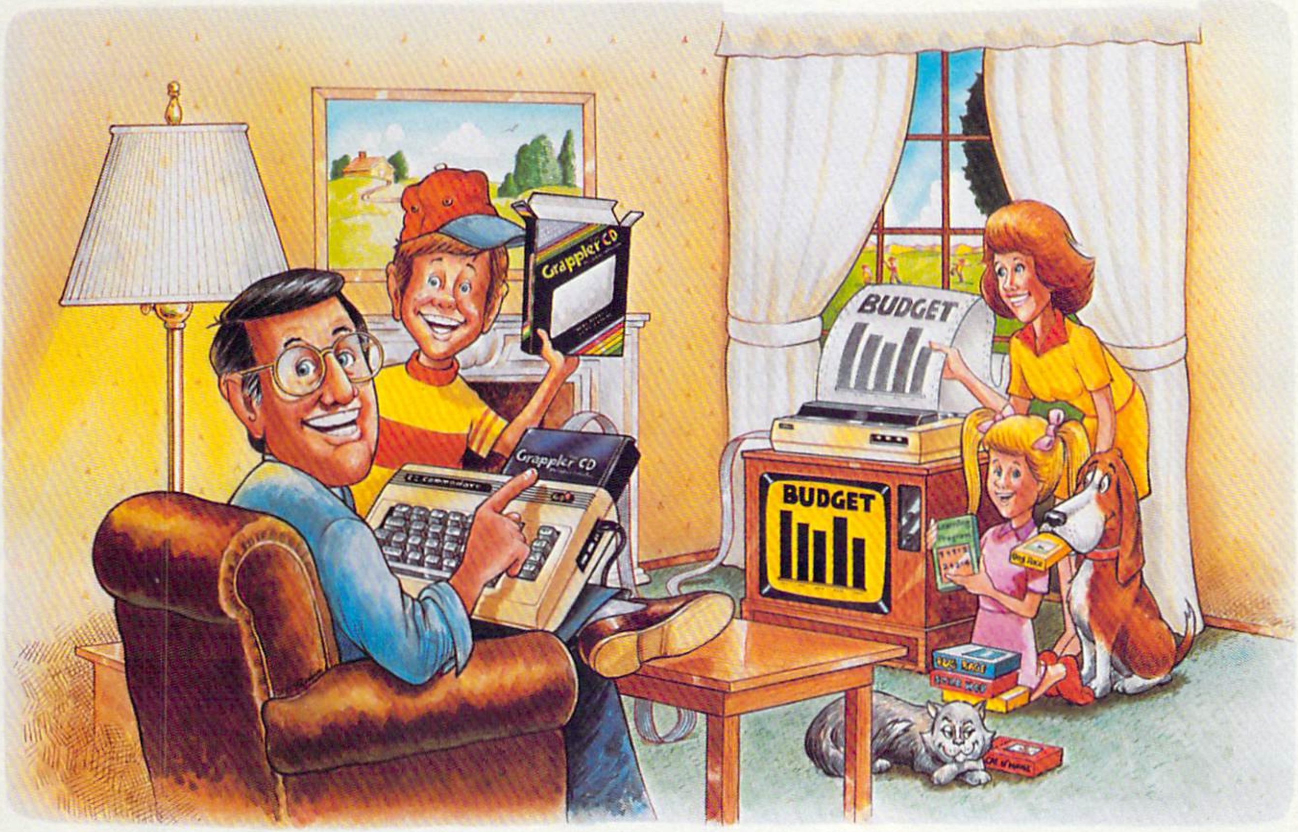

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Illustration by Carl Wesley

Sound & Music

The C-64 might be the best musical instrument of all time. Think about it: Can you picture Beethoven composing an article like this on his keyboard? Brahms writing letters between lullabies? Or Bach relaxing from fugues with a game?

By PEGGY HERRINGTON

The versatility and affordability of the C-64 aren't the only things that make it a superior music machine. What *does* is a tiny piece of processed sand called the Sound Interface Device (SID).

The SID is one of the most sophisticated electronic music synthesizers in any personal computer today. It has three voices, with attack, decay, sustain and release envelopes for each; filtering, ring modulation and synchronization; and four waveform generators. But that's not the best part.

Almost all computers can produce sound of some sort, but, unlike other computers, every feature on SID can be manipulated, changed and controlled from the keyboard—without any additional hardware. Straight out of the box, SID can produce just about anything you can imagine.

To take full advantage of this synthesizer-on-a-chip, you must know something about music and Basic programming. So what can you do if you know little about the latter and even less about the former (except what you like)? Read on—even if you've got two left feet, don't know a loop from a menu and can't keep time with a watch. Help is here.

You learn to play the synthesizer the same way you learn to play any other musical instrument. You practice!

Here's how you do it with the Commodore 64. Type NEW and press the return key, then type in Listing 1. Save it on tape or disk before you run it.

The Poke statement is used frequently. Before continuing with this article, I suggest you read its sidebar on Pokes and Peeks.

Almost all computers can produce sound of some sort, but, unlike other computers, the C-64 features sound that can be manipulated, changed and controlled from the keyboard—without additional hardware.

Program Description

You begin with a remark on line 10. In line 20, you state that S shall mean 54272 for the rest of the program. Then you turn off the SID chip by Poking zeroes into all the registers with a For. . . Next loop. The first time through the loop, I is worth 0 (FOR I = 0 TO 28); it's added to S (S + I), and is Poked into 54272 (POKE S + I , 0). When the program encounters the Next statement, it automatically goes back to the last For statement and increases the value of I by 1; then 54273 (S + I) is Poked with 0. When the Next statement is again encountered, I becomes 2, 54274 is Poked with 0, and so on, until the entire SID chip is cleared, or turned off.

Line 30 Pokes the attack/decay and sustain/release into the appropriate registers for voice 1. You can change the nature of the sound by changing the numbers following S + 5 or S + 6. The A/D and S/R, used here in cooperation with the sawtooth wave, produce a banjo-like sound.

```
10  ***C64 BASIC MUSIC LESSON***
20  S=54272:FOR I=0TO28:POKE S+I,0:NEXT:REM CLEAR SID CHIP
30  POKE S=5,3:POKE S=6,0:REM A/D AND S/R FOR VOICE 1
40  POKE S+24,15:REM TURN ON VOLUME
50  READ HF,LF:REM GET HI & LO FREQ FROM DATA BELOW
60  IF HF= -1 THEN POKE S+24,0:END:REM CHECK FOR END OF DATA
70  POKE S,LF:POKE S+1,HF:REM LOW AND FREQUENCY (PITCH)
80  POKE S+4,33:REM GATE ON WAVEFORM
90  FOR I=1TO200:NEXT:REM SOUND DELAY
100 POKE S+4,32:FOR I=1TO10:NEXT:REM GATE OFF:SILENCE DELAY
110 GOTO 50:REM DO IT AGAIN
200 DATA 16,195,17,195,18,209,19,239,21,31,22,96,23,181,
    50,30210 DATA 26,156,28,49,29,223,31,165,33,135
300 DATA -1,-1
```

Listing 1. C-64 Basic Music Lesson program.

You turn the internal volume all the way up in line 40, as 15 is the highest setting. Adjust the volume control on your monitor or TV to a comfortable level.

Read and Data

When the C-64 finds a Read statement (in line 50), it automatically looks for accompanying data (which can be anywhere within the program—in this case, lines 200–300). The Read and Data statements work as a team: You can't have one without the other. Notice that the Read statement is followed by two variable names: HF, which contains 16, and LF, which contains 195. Picture these as the labels on boxes that will hold the data.

When the Read statement is found, followed by two variables, the computer will look at the first Data statement it finds in the program and pick up the first two units after the word DATA. It knows that pieces of data are separated by commas.

Skip line 60 for the moment. Line 70 Pokes the data in HF and LF into the high frequency and low frequency registers for voice 1. Notice that READ HF is first (in line 50), but the computer goes to POKE LF first (in line 70). I could have reversed the order of these, but I want you to note that sometimes things seem to happen backwards in a computer. The important thing is to Poke the HF number into the high frequency register and the LF number into the low frequency register. If you do it the other way around, you'll get squeaks instead of tones when you run the program.

What has happened so far? You've cleared the SID chip, established the ADSR envelope, turned on the volume and put in the numbers that control pitch. Do you have a tone sounding yet?

No! Only after line 80 will you hear anything. This is where you select and turn on the waveform, and until you do that, no sound will be produced.

Now that you've implemented line 80, you have a tone sounding. By means of a delay loop, line 90 prevents this tone from playing forever. It instructs the computer to count 200 jiffies before going on to the next instruction. A jiffie is 1/60th of a second in real time, so

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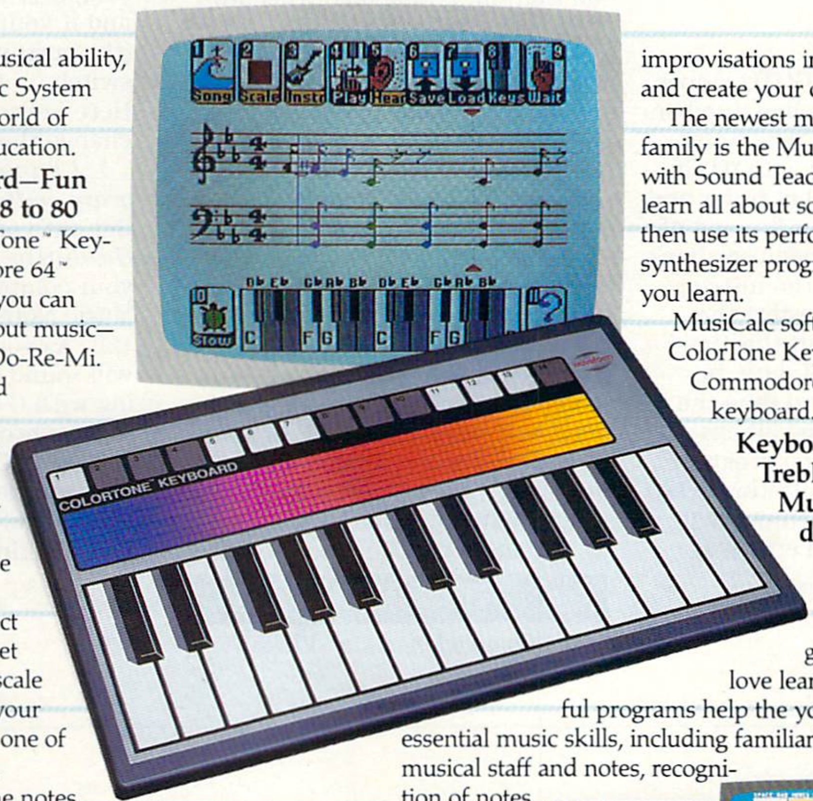

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As you play, you'll see the notes you're hearing displayed on a musical staff. That's something no other musical software can do! And with the ColorTone system you can record your musical creations to listen to them again and again.

With Waveform's ColorTone Keyboard, your very first musical experience can be fun and rewarding. Every time you play you'll develop greater musical competence. And confidence.

While you can use the ColorTone Keyboard by itself, it will also add new dimensions to the other software products in Waveform's creative music system.

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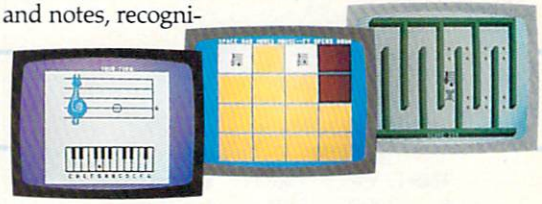

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200 jiffies isn't very long. After counting to 200, the program goes to line 100, where you turn off the sound by Poking S + 4 with 32, which removes the 1 that turned on the sound in line 80. The sawtooth wave is still being generated, but you can't hear it now. After turning off the sound, the computer counts ten jiffies (FOR I = 1 TO 10:NEXT) before going on to the next instruction. This puts a very brief silence between tones.

The GOTO Loop

The beginning of a GOTO loop is at line 110. While the line numbers establish the order in which the computer does things, a GOTO instruction interrupts that order and sends the program to a line out of sequence. GOTO 50 means go back to line 50 and follow the instructions there. So, you restart the Read/Data process, but this time with the second set of data, because this is the second time the Read instruction in line 50 has been implemented. The program will continue to execute this GOTO loop until it has gone through all the data, but it would end in a Syntax error without line 60 (which you skipped over earlier).

The Power of If. . . Then

Computers programmed in Basic can make decisions because of the If. . . Then statement. The premise is: If something is true, Then do so-and-so. When the condition checked is false (when HF does not equal − 1 in this program), the instruction following THEN is ignored (along with everything else on that line). Line 60 of this program says to see if the value of HF is equal to − 1, which is used as a flag. Now remember, each time new data is read, as the program returns to line 50, the value in the boxes labeled HF and LF will change. And each time, the value of HF will be compared with − 1 because of line 60. If you look through the data starting on line 200, you'll see that the last pair to be read will be − 1, − 1. *Two* negative 1s are necessary because the computer picks up two pieces of data at a time (READ HF,LF), and it will stop and send you an error message if it can't get both of them. When it reads this last pair, it will again check HF to see if it equals − 1, and bingo! This time it will. Then, following the instruction after THEN in line 60, it will turn off the volume and end the program. That's how you get out of a GOTO loop.

Play Around

When you have the program up and running, listen to it a few times, then experiment with it, making it produce different sounds. You can't damage your computer through keyboard input, and if your machine freezes up (the cursor disappears), simply switch it off for a few seconds. Here are some ways you might change the program:

1. *Change the data so the program will sound different tones.* Get out your *Commodore User's Guide* (the book that came with your computer) and look at the Music Note Values, starting on p. 152. As your program stands, it will sound an octave higher, starting with C-4 (middle C). The data in your program was taken from p. 153. Find C-4 in the Octave column and read across to the columns headed Hi and Low, where you will find the first two items of

RUN It Right

Commodore 64 or VIC-20

SID Memory Addresses S = 54272				SID Chip							
Voice 1	Voice 2	Voice 3	**Register Name**	128	64	32	16	8	4	2	1
S	S + 7	S + 14	**Low frequency**	F_7	F_6	F_5	F_4	F_3	F_2	F_1	F_0
S + 1	S + 8	S + 15	**High frequency**	F_{15}	F_{14}	F_{13}	F_{12}	F_{11}	F_{10}	F_9	F_8
S + 2	S + 9	S + 16	**Pulse width—Low**	PW_7	PW_6	PW_5	PW_4	PW_3	PW_2	PW_1	PW_0
S + 3	S + 10	S + 17	**Pulse width—High**	—	—	—	—	PW_{11}	PW_{10}	PW_9	PW_8
S + 4	S + 11	S + 18	**Control register**	Noise	Pulse	Sawtooth	Triangle	Test	Ring Mod.	Sync.	Gate
S + 5	S + 12	S + 19	**Attack/Decay (A/D)**	A_3	A_2	A_1	A_0	D_3	D_2	D_1	D_0
S + 6	S + 13	S + 20	**Sustain/Release (S/R)**	S_3	S_2	S_1	S_0	R_3	R_2	R_1	R_0
Filters:		S + 21	**Low cutoff**	—	—	—	—	—	FC_2	FC_1	FC_0
		S + 22	**High cutoff**	FC_{10}	FC_9	FC_8	FC_7	FC_6	FC_5	FC_4	FC_3
		S + 23	**Resonance**	Res_3	Res_2	Res_1	Res_0	Filter Ext.	Filt 3	Filt 2	Filt 1
		S + 24	**Volume and filters**	3off	HP	BP	LP	Vol_3	Vol_2	Vol_1	Vol_0
Misc:		S + 25	**Pot X**	PX_7	PX_6	PX_5	PX_4	PX_3	PX_2	PX_1	PX_0
		S + 26	**Pot Y**	PY_7	PY_6	PY_5	PY_4	PY_3	PY_2	PY_1	PY_0
		S + 27	**OSC_3**	O_7	O_6	O_5	O_4	O_3	O_2	O_1	O_0
		S + 28	**$Envelope_3$**	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0

Table 1. *Commodore 64 sound interface device.*

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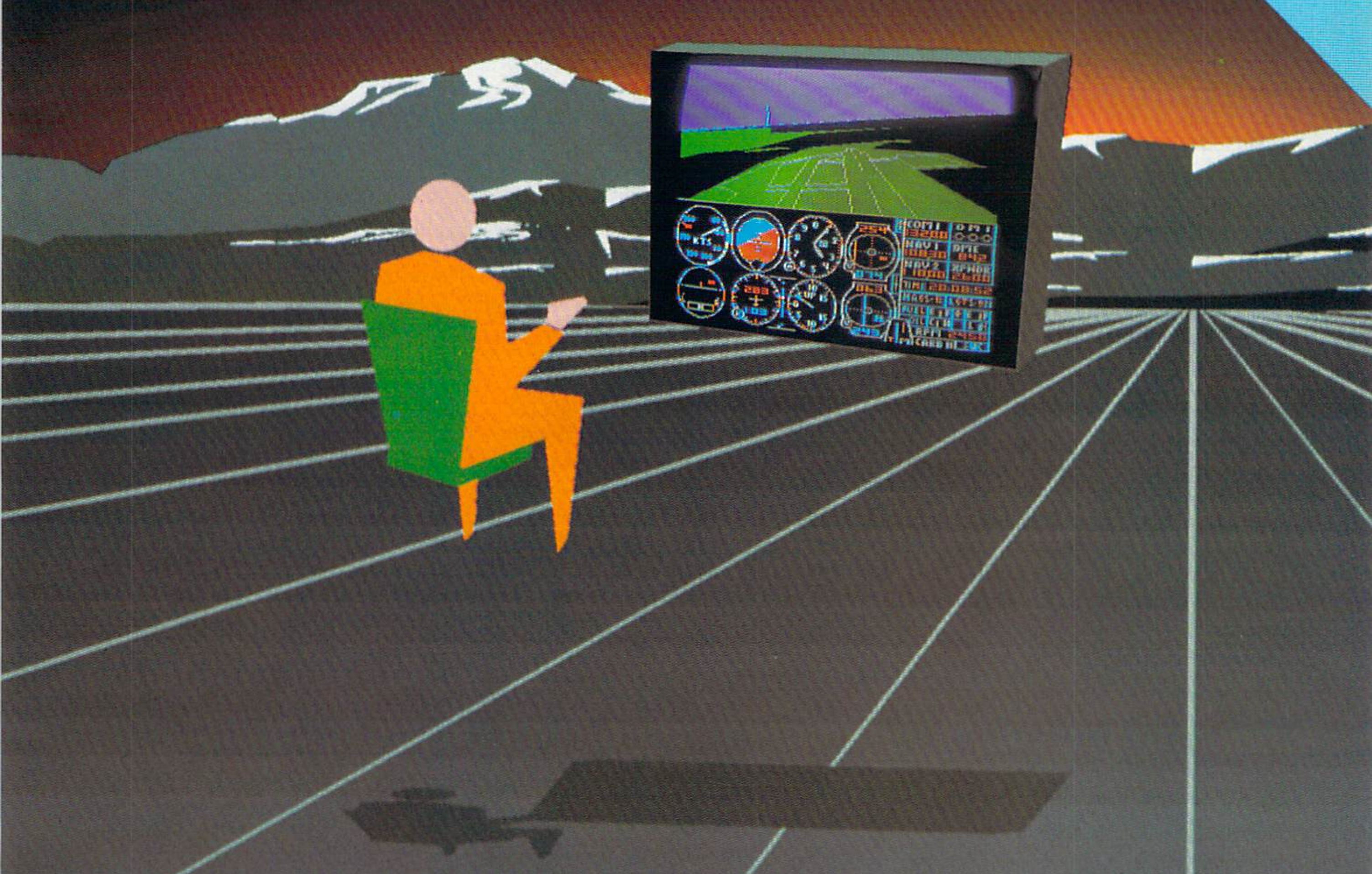

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data in line 200. You can successfully change the data (even add more program lines) as long as you're careful to keep it in Hi and Low pairs and leave the two −1s as the last entries. Experiment!

2. *Change the waveform.* This program uses a sawtooth wave (value 32), turned on in line 80 and turned off in line 100. Change the waveform, and you'll change the quality of the sound. Try using the triangle waveform (value of 17 in line 80 and 16 in line 100) or the noise (129 in line 80, 128 in line 100). You can use the pulse wave, too (value 65 in line 80, 64 in line 100), but add this line to the program:

```
35 POKE S+3,10: POKE S+4,
   150: REM PULSE WIDTH
```

3. *Change the ADSR Envelope.* You can imitate different musical instruments if you have the ADSR settings or by just messing around with strange sounds. POKE S+5 with the AD number and S+6 with the SR number (both in line 30), and use the sawtooth wave (value 32) to get these instruments: banjo AD=3,SR=0 (this is how your original program is set up), piano AD=10,SR=9, calliope or organ AD=0,SR=240. Use the pulse wave with line 35 and AD=9,SR=0 for a guitar sound. Try these ADSR settings with other waveforms for still different sounds.

Much has been made of the music capability of the C-64, but did you know that the VIC-20 can also carry a tune or two? Here's a music lesson that teaches you how to get sound from your VIC-20.

A couple of years ago, my unsuspecting husband brought the tip of an iceberg home under his arm.

"You bought a what?" I said. He was attaching it to the TV when I walked off.

"I think you'll like it," he said to my back. "It makes music."

I *didn't* like it. I *loved* it. Even all the hoopla about the Commodore 64's music synthesizer hasn't cooled my ardor for my little VIC.

To get organized sounds from the VIC, you must have both music and Basic programming knowledge.

The VIC has four voices—three are musical and one is *white noise* (like what you hear between channels on a TV). There aren't a lot of complicated sound controls, and it has everything you need to make music and sound effects. There are five memory locations (also called registers or bytes) devoted to sound (see Table 2).

The first three registers in Table 2 control musical pitch, the tones that make up melody and harmony. Incidentally, C_4 is middle C. Each voice has a range of three octaves (an octave is 12 adjacent tones), but since they overlap each other, the VIC's overall range—that is, from the lowest to the highest tone it will sound—is five octaves. If you have a piano, forget the lowest octave and the two highest octaves, and what's left is the VIC's range.

The VIC's volume must be turned on internally to get any sound. You do that by Poking a number from 1 to 15 into register 36878. (Before continuing this article, refer to the sidebar on Pokes and Peeks.) After you turn on the volume, you Poke the number that corresponds to the pitch you want into one of the voice registers. To hear middle C (C_4) in the low voice, type NEW, press the return key and enter these lines:

```
POKE 36878,15
POKE 36874,240
```

The fastest way to stop the sound is to simultaneously hold down the run/stop and restore keys. This resets the VIC's pointers and clears the screen. A better method is to use the cursor controls and change 240 to 0, pressing the return key while the cursor is still on that line. You can also turn off the volume (POKE 36878,0) or Poke a number under 128 or over 255 into the voice register. (If you don't get any sound when you type in the lines, check the volume on your TV or monitor.)

Now listen to middle C on the middle voice:

```
POKE 36878,15
POKE 36875,225
```

After that, try middle C on the highest voice:

```
POKE 36878,15
POKE 36876,195
```

If you listen carefully, you'll realize that these tones sound slightly different on each voice. The pitch is the same (it's middle C), even though the numbers 240, 225 and 195 differ (because the voice ranges overlap), but the quality of the sound, the element musicians refer to as *tone color* or *timbre*, is not quite the same. The lower voices are more mellow, or smoother, than the high voice. This is so that a melody, which is usually higher in pitch when harmonized, will stand out from the other voices when put on the high voice.

The VIC can sound many pitches (or musical notes) that regular acoustic instruments can't. You've been making the VIC sing in Direct mode so far. Now change to Program mode and listen to all the pitches (the range) on the VIC's lowest sound register. Clear memory with NEW {return} and type in the following program. Leave the remarks in (everything after REM on a program line is ignored by the computer) until you understand what's happening throughout the following program.

```
10 S=36874:V=36878:T=128
20 POKE V,10:REM TURN ON VOLUME
30 POKE S,T:REM SOUND TONE
40 FOR D=1TO100: NEXT D:REM SOUND
   DELAY LOOP
45 POKE S,0: FOR T=1TO50: NEXT D:REM
   SILENCE DELAY LOOP
50 T=T+1:REM INCREMENT TONE
60 IF T>253 THEN POKE S,0:END:REM
   CHECK FOR END
70 GOTO 30
```

Save the program before you run it. The first line initializes the

Memory Location	Register Name
36874	lowest voice (range from C_1 to C_4)
36875	middle voice (range from C_2 to C_5)
36876	highest voice (range from C_3 to C_6)
36877	white noise
36878	volume control

Table 2. *VIC's sound memory locations.*

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variables and constants. You could have picked any letter (or combination of two letters or a letter and a number) to stand for speaker (S), volume (V) or tone (T), but these particular letters will help you remember what's what later on in the program. Using variables, which usually change in value during a program, and constants, which don't, instead of register numbers, has several advantages. They are easier to type in and lessen the chance of error; they use less memory and the VIC can work faster with them than with numbers.

For...Next Loops

You turn on the volume in line 20. Line 30 Pokes the first audible tone (the computer automatically substitutes the current numerical value for a variable in a program, in this case it's 128) in the low voice register (36874), and you hear it. The For...Next loop in line 40 instructs the VIC to count 100 jiffies before going to the next instruction. This controls the length of time the tone plays (try removing line 40 and see what happens).

Here's how it works: the VIC recognizes the For statement and the controlling variable after it (D, which, in this case, means delay). D takes on the value of the first number after the equals sign (D = 1) and the VIC then looks at the next instruction, which, in this case, is NEXT D. When it recognizes this, the VIC automatically returns to the For statement and increments D by 1, after which it goes to the next instruction again—NEXT D—and this continues until D equals the number after TO in the statement. This process is called a loop. When D finally does equal 100, the VIC will go to the instruction after the NEXT D and carry on from there.

This delay loop is an example of the simplest application of For...Next in Basic. You can do elaborate programming with a For...Next loop by putting instructions between FOR and NEXT and coordinating the control variable (D) and range (1 to 100) with other aspects of a program. For...Next loops can also be "nested," one inside another. Add this to the fact that For...Next loops are used frequently—there's another one in line 45 of this program—and you can see that this is a powerful Basic tool.

Before the second For...Next loop is encountered in line 45, however, you tell the VIC to turn off the tone being sounded (POKE S,0). It does this and then counts to 50, this time using the variable I, to produce a brief silence between tones. There are 60 jiffies in a second (yes, there's a clock built into the VIC), and you should change the number of jiffies in this program's delay loops, to get a feel for this method of timing.

Remember, T stands for tone and was initialized to a value of 128 on line 10. The statement T = T + 1 is *not* an algebraic equation. It's an old computing technique that used to be prefaced by the word LET. If you keep that in mind, you will understand this statement to mean "let the value of T be the value it is now, plus one." This means T has a value of 129 after line 50.

GOTO Loops

Skip line 60 for the moment. The order in which instructions are performed in Basic is controlled by program line numbers. Sometimes you want instructions repeated or executed in an order different from that established by line numbers. The instruction on line 70 is an example of another type of loop, a GOTO loop, which does both of these things. The VIC recognizes the GOTO in line 70 to mean "move to line 30 and follow the instructions there." (You can tell a computer to go to any line number, either forward or backward, in a program.) So the VIC loops back up to line 30 and sounds another tone. Each time this happens, T is worth one more than it was the previous time, so the tone increases a little in pitch. This GOTO loop includes everything between lines 30–70.

Creating a GOTO loop is tricky and can get you in trouble if you don't structure it very carefully. For example, without line 60, the loop created in line 70 would be an infinite loop. You could stop it only by interrupting the program manually. In this program, two things will prevent this from happening, and one of them is not an instruction.

When the GOTO loop has done its thing 128 times, T will have been incremented to a value of 256, and when the VIC tries to Poke 256 into the sound register (or any register), it will halt operation and send an error message. No register in an 8-bit processor (such as the VIC) can accommodate a number larger than 255. But this won't happen to you because of the instruction in line 60.

If...Then Revisited

The power to make a decision is vested in this Basic statement. The VIC will test the condition presented by the If statement, and only if it's true will it perform the instruction following the Then statement. So, each time through the GOTO loop, the VIC checks to see if T is greater than 253. If it's not, the VIC disregards the rest of that line.

(You may have noticed a flaw in the numbers. I said the maximum allowable Poke value was 255—and it is—but the program checks to see if T equals 253. Try changing 253 in the program to 255 and listen to what happens.) When T finally *is* greater than 253—when T = 254—the instruction following THEN is carried out. The potentially infinite GOTO loop is terminated, and the program ends.

Try to change parts of this program to make different sounds. Try deleting line 45 (use the cursor controls to insert REM just after the line number, and you won't have to retype the line to re-implement it—just remove the REM statement). With that omission, you'll hear a sweep of the tone generator as opposed to individual tones.

Increment T in line 50 by a larger number to space the tones farther apart; for example, change it to T = T + 2. Remove line 50 and you'll create an infinite loop in which you'll get the same tone over and over. (You'll get the same result by changing line 70 to GOTO 10. Can you figure out why?) By all means, change the speaker (S) value to another one of the sound registers (S = 36875, 36876, or 36877) and listen to the differences.

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Commodore Pokes and Peeks

You really have to Poke the Commodore 64 to make SID sing. When you Poke a Commodore computer, you're giving an explicit, understandable (to the computer) order, which will be carried out when you press the return key, in Direct mode, or when you run a program. The computer understands the format POKE (memory location), (value). Remember, there are two kinds of memory in a computer, RAM (random access memory), which is where instructions like Poke are kept, and ROM (read only memory), the "brain" of the computer, which will follow those instructions if they're in the proper form.

The computer understands certain abbreviations, too. You can use a letter (called a constant) as a stand-in for a memory location, provided you specify so early in the program. Use the letter S, because it's easy to remember, to stand for the first memory location (or address) of SID. To do this, you just say S = 54272. Whenever S appears in the program (and it's not inside quotation marks or part of a reserved word), the computer will substitute the number 54272. It's easier for you to type S than 54272 throughout the program, and it's faster (believe it or not) for the computer to use S than 54272 while it's working.

From then on, you'll add to S a number between 1 and 28, to indicate another SID chip address: S + 4 means memory location 54276 (54272 + 4). That particular memory location contains some important parameters for voice 1. By Poking 54276 (represented as S + 4) with a specific predetermined value (which I'll explore in a moment), you can turn on (or enable) one or more of four waveforms, the test bit, ring modulation, synchronization or voice 1. The options you select depend on the value you send with the Poke instruction.

When you Peek a memory location, you're doing the opposite of Poke. You're asking the computer to tell you what value is stored in a particular register. SID registers from 54272–54296 (S through S + 24) can't be Peeked: they're called write-only registers. You can Peek memory locations 54297–54300, and you do it like this: PRINT PEEK(54297). These are read-only registers, however, which means they can't be Poked. As it turns out, SID is unusual in this respect. Most memory locations can be successfully Peeked and Poked.

In this example (POKE S + 4,33), you're telling the C-64 to Poke a value of 33 into memory location 54276. Let's see what the 33 means.

Bits, Bytes and Nybbles

A byte is what I've been referring to as a memory location, or a register (54272 is the first byte in the SID chip). But the smallest unit inside all computers isn't a byte, it's a bit, and there are eight bits in every byte. (Four bits—half a byte—is called a nibble.)

Look at the SID chip chart (see Table 1). The smallest box in the grid on the right represents one bit. Reading horizontally to the left, (eight bits) is one byte. The computer organizes bytes by memory address; for example, 54276 or S + 4. See if you can find that byte on the chart. Start on the left at the SID Memory Addresses and read down the column for voice 1 until you come to S + 4. Now look across to the Register Name column; that byte is called the control register. Continuing to the right, you can see the eight bits that constitute the byte at 54276.

Notice voices 2 and 3 in the columns next to S + 4. The SID chip is conveniently divided into two types of registers—those that affect a single voice, and those that affect all voices together. The top half of this diagram represents those registers that affect the single voices 1, 2 or 3. Seven registers affect each voice independently, so you can simply add seven to each address for voice 1 (S + 4 + 7 = S + 11), to get to the control register for voice 2. Add another seven to get to voice 3.

The top row of boxes contains the numbers used to turn on particular bits in the byte you're addressing. These are the predetermined values, mentioned earlier, which are Poked into memory locations. With this information, you can interpret the value of 33 in the instruction POKE S + 4,33.

In this case, 33 is the sum of column 32 and column 1. You're telling the C-64 that you want it to use the sawtooth waveform (a value of 32) and turn on the sound (with a value of 1) for voice 1 (memory address 54276). POKE S + 4,33 says all this. To silence voice 1, you can turn off the sound with a value of 0 by sending the instruction POKE S + 4,32. Even though you've turned off the sound, the sawtooth wave is still being produced; you simply can't hear it.

Number Systems

In binary, the number 33 would be represented as 00100001, in which the 1s mean switches on, and the 0s mean switches off. I'm not going to get into the details of the binary number system. Suffice it to say that binary, the number system used by computers, is based on the powers of 2. Table 3 shows the bit numbers of a byte (increasing from right to left), along with the corresponding powers of 2 and their equivalents in the decimal system.

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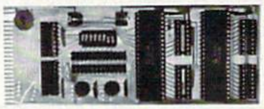

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Notice that the bit numbers are the corresponding exponents of 2 . Compute 2 to the power of 5 ($2^5 = 2\times2\times2\times2\times2$) and you'll get 32, one part of the decimal number you used to Poke into the memory location in our example. You enabled bit number 5 by Poking 32 into the register. (Exponentiation is accomplished on the C-64 with the up-arrow key, which is just above the return key. To get the result of 2 to the 5th power in Direct mode, type PRINT 2 (up arrow) 5, and press the return key.)

The largest number you can Poke into a byte is 255 (128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 equals 255); doing so enables every bit in that byte. Numbers larger than 255 must be split between two bytes. To figure out which bits are being enabled by a Poke value, subtract the largest power of 2 (in decimal form) that is equal to or less than the Poke number itself. Let's say the Poke value is 133; 133 minus 128 (which enables bit #7) leaves 5; 5 minus 4 (which enables bit #2) leaves 1, which enables bit #0. So Poke 133 enables bits 7, 2 and 0. 133 as a binary number is 10000101.

From now on, when you're instructed, "to hear a sawtooth wave you must enable bits 0 and 5 in the SID Control Register for Voice 1," refer to Tables 1 and 3 and translate that into POKE S + 4,33. With a little practice, you'll even know what you're doing!

7	6	5	4	3	2	1	0	Bit number
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Powers of 2
128	64	32	16	8	4	2	1	Decimal values

Table 3. *Bit numbers and corresponding powers of 2 with their decimal equivalents.*

Terms You Should Know

SID addresses, or *registers*, start at memory location 54272, which I'll refer to with the constant S. I'll add a number to S to refer to the other SID registers, like this: S + 4, which means 54276. A C-64 tone generator is called a *voice*.

Pitch, or *frequency*, is a tune's highness or lowness, which is determined by how often a sound wave vibrates during each cycle. The SID chip controls a sound's frequency by using two registers per voice. These registers are called low frequency and high frequency (S and S + 1 for voice 1).

Dynamics deals with the amplitude of sound: how soft or loud it is. The volume control on the C-64 (which affects all voices equally) is at S + 24, which also controls the filters. It must contain a number above 0, or you won't get any sound at all.

Filtering a voice alters the harmonics of the waveform, which usually reduces the volume of the voice. This is usually used to de-emphasize one voice in order to highlight another. You must tell the 64 which voice to filter and to what degree, with register S + 23, and set the reference points at S + 21 and S + 22 (for voice 1 only).

Timbre, or tone color, deals with the individual qualities by which you distinguish one voice from another. For example, Concert A is a specific frequency (440 Hz), which is the standard for tuning orchestral instruments. Each musician tunes his or her instrument to concert A, as sounded by the first violin. Timbre is the difference in the sound you hear when, say, a harp and a horn play the same tone. It's what makes our voices differ.

Control of timbre on the C-64 is done with the ADSR envelope generators (two for each voice, S + 5 and S + 6 for voice 1) working in conjunction with the waveform you select. ADSR stands for attack, decay, sustain and release. These are the physical features of a sound's *envelope*.

Orchestration is described as texture. This can range all the way from a guitar solo to a symphony orchestra. The most you can have is three-part harmony, but you can trick your senses into thinking you have more than that. Start out with, say, a drum, guitar and bass trio, but along the way, change the guitar to a horn. This makes you think you are hearing four voices. This is accomplished by a program to coordinate multiple voices.

Timing includes the overall tempo of the piece—fast, slow or somewhere in between—and the rhythm.

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Introduction To Graphics

Generating graphics on a computer—any computer—can be a difficult, time-consuming task at best, and close to impossible if you are just starting out. We are surrounded by computer graphics in movies, television, software, posters and book covers, so it is not surprising that once you own a computer, you want to try to generate some of your own graphics.

The problem arises when you actually sit down with the manual or a book and try to decipher all those terms and techniques. The C-64 and VIC-20 are especially frustrating because you know that these micros are capable of some amazing graphics, yet there are no instructions in Basic to use these capabilities. Programs can only achieve their display magic through Pokes, Peeks, ANDs, bytes, bits, nibbles and so on.

If you are just starting out, you would rather play a little bit first and then ease into understanding the hows later on. It is much easier to analyze someone else's working program than to start writing your own from scratch.

With that idea in mind, we are presenting four short graphics programs for you to type in, play with, change, analyze and learn from. But first, let's talk about the kinds of graphics you can do with your Commodore computer.

There are three kinds of graphics available on the VIC-20 and four on the C-64: keyboard graphics, programmable character graphics, bit-mapped or high-resolution graphics and (on the C-64) sprite graphics. We will take a quick look at each of these.

Keyboard Graphics

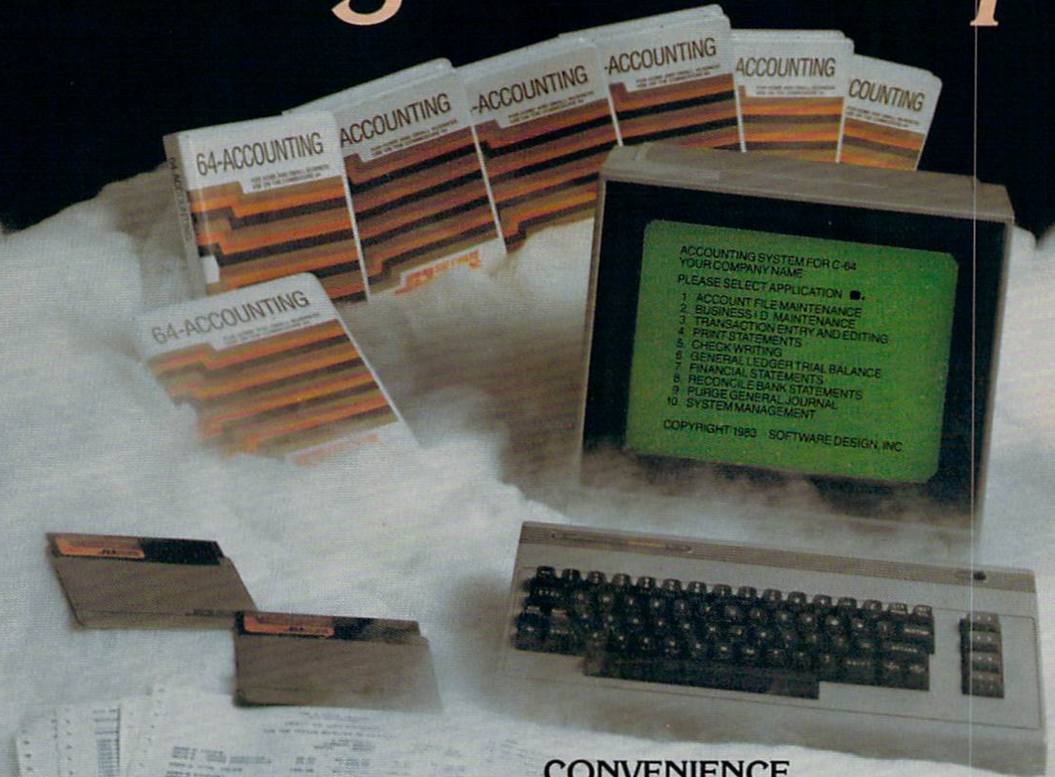
The first time you saw a VIC-20 or C-64 keyboard, you probably noticed the two graphics symbols under the letters on each key—little hearts, checkerboards, lines, curves—62 possible symbols in all. You can display the ones on the right under each key when you hold down the shift and press a key; the ones on the left are printed by holding down the C= (Commodore symbol key on the lower left) and pressing a key.

If you have spent more than five minutes with a Commodore, then you probably played with these graphics at one time or another. You may even have written programs using them. Don't count them out! There have been many impressive programs written using nothing but these graphics. They have the advantage of being simple to use and manipulate. Combined with the reverse on/off and the text-coloring abilities of either computer, you can achieve many "sophisticated" graphics effects.

A tip when using keyboard graphics: Clear the screen, then create your designs. When finished, move the cursor to the upper left, then type a line number,

Computer image by William C. Bramble III © 1984

64 Software Beyond Compare



```
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question mark, quote mark and then press the return key. Repeat with a new line number and so on, all the way down the side of the screen. Now if you type LIST, your screen design will be part of a program. You should then be able to go back, edit the drawing and insert color change codes—put the cursor on top of the character to be changed, press the shift and inst/del keys, followed by the shift and color keys (1–8). This may be a bit awkward, but at least it doesn't involve Pokes or Peeks.

Programmable Character Graphics

When you press a key on the keyboard, the Commodore normally rushes off to a section of memory where it keeps a list of instructions on how to draw characters on the screen. Each letter, number and keyboard graphics symbol has its own instructions.

Take a box and divide it into 64 little squares (an 8 by 8 grid). Each square represents a dot on the screen. By filling in the little squares, you could draw a crude letter or number. Each of these 64 squares is either filled in or empty (on or off), depending on the character being drawn. Eight bits in a byte. Eight bytes in a character. Eight bits times eight bytes gives you 64 squares per character.

In the usual case, the computer refers to a certain location to find these eight bytes of information for each character it has to print on the screen, but in programmable character graphics we tell the computer that it can find the information in a different part of memory, where we can change the eight bytes for each character. Then when the computer prints a character, it goes to our list and finds out how to draw the character according to our specifications, instead of the ones provided at the factory.

For example, you could program the computer so that the letter A would represent a dragon's head; B could be programmed to look like a dragon's body; and C a dragon's tail. Once programmed correctly, the computer would print a dragon when we tell it to print ABC. The trick is keeping track of all those bits and bytes. Tedious with pencil and paper, simple if you let the computer help.

Bit-mapped or High-resolution Graphics

You can turn on or off each dot on your screen or monitor, if you know how. This is an explanation of high-resolution graphics in the simplest possible terms.

If each character has 64 of these little dots, or pixels, and there are 40 characters per line (22 on the VIC-20) and 25 lines per screen (23 on the VIC-20), there are 64,000 dots on the C-64 and 32,384 dots on the VIC-20 per screen. That is quite a few little dots to turn on and off or to change color.

On the surface it is relatively simple to activate high-resolution graphics on a Commodore. All you do is tell it that you want to set the dots yourself and indicate which ones.

However, when you get right down to it, there are an awful lot of dots on a high-resolution screen (more dots than memory, if you wanted to write a program using data statements to set each dot, one at a time). It can also be a bit time-consuming. Try a For. . .Next loop that just counts up to 64,000, and you will see how long it would take to clear a high-resolution screen if you were turning the dots off one at a time. (You could use some tricks in high-resolution graphics programming to speed things up.)

High-resolution, bit-mapped graphics is the most detailed and impressive of all the kinds of graphics available for the Commodore computer, but it can be slow, memory-consuming and complicated to program—unless you have a program to help.

Sprite Graphics

Sprites are blocks of bytes that the C-64 can manipulate quite easily. That does not mean that humans can manipulate them easily. Just the opposite, really. Sprites are composed of 63 bytes (the 64th byte is used as a placeholder)—three bytes for each row, 21 rows for each sprite.

When you tell the computer to turn on sprite number 1 at location X,Y, the entire block of 63 bytes is placed on the screen at the desired location. Sprites are similar to enlarged characters in that the entire block is treated as a single unit, making it faster to move and manipulate than an image that uses high-resolution graphics. The trick is defining the sprite so that it looks like something.

Once defined, it is a relatively simple task to tell the computer where to put the sprite on the screen. Most commercial games use sprites, and there is no reason why you shouldn't use them in your own programs. The sprite editor program will get you halfway there, and with some patience and the *Programmer's Reference Guide*, you should have sprites dancing about in no time.

Sprite Notes

Once you have a sprite designed and the appropriate data numbers, what do you do with them? Here is a highly simplified procedure for getting a sprite from data statement to screen.

1. You should have 63 bytes or numbers in data statements (the accompanying sprite designer program will give you the numbers). You must first put them into memory to "define" the sprite. (We will use locations 12288 through 12350 for sprite 0.) Write a For. . .Next loop to read the data and Poke it into place.

```
10 FOR T = 12288 TO 12350 : READ D :
  POKE T,D : NEXT
```

2. Set the pointer (so the computer knows where to find the sprite).

```
20 POKE 2040,192
```

3. Turn the sprite on. (Use V = 53248, the address of the video chip, to simplify turning on and turning off.)

```
30 V = 53248 : POKE V + 21,1
```

4. Set the sprite color. (We will use 2 for red.)

```
40 POKE V + 39,2
```

5. Set X and Y positions. (Since X can range from 0 to 511, any position above 255 must POKE V + 16,1 before Poking X values.) For example, if you wanted to set X value to 257, the setting would be POKE V + 16,1 : POKE V + 0, (257 – 256). (We will use an X value of 100 and a Y value of 100.)

```
50 POKE V + 0,100 : POKE V + 1,100
```

This should put your sprite on the screen.

See the following articles and programs for more information on various aspects of graphics. **G.W.**

Color Your C-64 Canvas

By R.A. FRECHETTE

Curved lines, line drawings, sketches, portraits, silhouettes, graphs and even paintings—all of these are possible on your C-64 in the high-resolution mode. Until now, very little had been written about this powerful graphics capability. This article brings to light some of the exciting possibilities you can accomplish.

In the high-resolution (HI-RES) mode, your Commodore 64 can give you graphics that are relatively sharp and clear—almost as good as your television set. The HI-RES mode uses dots instead of squares to outline objects or to fill in colored areas. This is why there is such sharpness of detail. All you have to do to draw in the HI-RES mode is to turn the appropriate dots on or off.

HI-RES

HI-RES is a graphics mode initialized by a series of Pokes. To illustrate, type the following statements into your computer:

```
10 BA = 8192:V = 53248
20 POKEV + 24,PEEK(V + 24)OR8
30 POKEV + 17,PEEK(V + 17)OR32
40 FOR I = BA TO BA + 7999
50 POKEI,0
60 NEXT
70 FOR I = 1024 TO 2023
80 POKEI,3:REM CYAN
90 NEXT
```

Run this program to see what lies in memory addresses 0 to 8191, the last 4K bytes of which is a character set. This is then wiped out, and a cyan screen to use as our canvas appears. You can pick your own screen color, of course, by putting the appropriate color code (1–8) in line 80.

RUN It Right
Commodore 64

Definitions and Other Facts

1. A square is a portion of the screen the size of the cursor—roughly ¼ inch wide by $^3/_8$ inch high on a 12-inch monitor. A square is made up of smaller squares called dots (or pixels) in an arrangement of eight across by eight down.

2. A line is a horizontal row of dots all the way across the screen. (This is not the same thing as a program line.) There are eight lines to a row.

3. You can have any border color you wish.

4. The color of the square is called the background color; adjacent squares can have different colors, but for now we will paint all of our background with the same color.

5. The canvas we will use is 320 dots across (horizontally) and 200 dots high (vertically). The location of any dot is given by values of X (horizontal and increasing to the right) and Y (vertical and increas-

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ing downwards). The dot in the upper-left corner of the screen is X = 0, Y = 0. 320 × 200 = 64000 dots on one canvas.

6. We are using memory addresses 8192 to 16383, although other addresses are possible. In HI-RES one picture requires 8000 bytes of memory.

7. The color address used is 1024 to 2023. You will recognize this as the usual screen memory address. (Ordinarily, screen color is at addresses 55296 to 56295.)

Turning It On

To draw a HI-RES picture you need two things: a way of turning the appropriate dot on and a way of telling the computer where that dot is located on the screen. The following statements will turn on any dot you wish. Add them to what you've typed so far.

```
1000 REM TURN ON DOT AT LOCATION X,Y
1010 R=INT(Y/8)
1020 C=INT(X/8)
1030 L=Y AND 7
1040 BI=7-(X AND 7)
1050 BY=BA+320*R+8*C+L
1060 POKEBY,PEEK(BY)OR(2↑BI)
1070 RETURN
```

To become a HI-RES painter, you must simply control the dots on your screen.

As a check on everything you've done so far, type in this small sketch:

```
100 FOR X=140 TO 180
110 Y=100
120 GOSUB 1000
130 NEXT X
140 FOR Y=80 TO 120
150 X=160
160 GOSUB 1000
170 NEXT Y
999 GOTO999
```

Line 999 freezes the picture on the screen until you press the run/stop or restore keys.

Bugs

Type RUN and press the return key. You should see a cross being formed in the middle of the screen. If you make a typing or programming error in HI-RES mode, you will not get the accustomed error messages. The only way to debug this mode is to attempt to determine where the program stopped functioning. Use the print statement in the Immediate mode to check the value of the variables.

For example, if you get a horizontal line but no vertical one, you know everything worked up to line 140. Press the run/stop and restore keys, then immediately type PRINT Y [RETURN] (also PRINT X and, in general, any other variables that are suspect). Use the answers to help you find the error.

Finding the Xs and Ys

To tell the computer which dot to turn on, it is a good idea to first obtain some 8½- × 11-inch paper lined four squares to the inch. Measure 40 squares horizontally, 25 squares vertically and draw a line all around. That is the size of your canvas (it also is our familiar 40-column by 25-row screen).

Listing 1. *High-resolution graphics program for the C-64.*

```
1 REM WHAT VALUES OF X AND Y LIVE AT A HI-R
  ES SCREEN COLOR ADDRESS?
5 PRINT"{SHFT CLR}"
10 PRINT"ADDRESS"
11 INPUT AD:IFAD<1024 OR AD>2023 THEN 10
20 FOR K=0 TO 24
30 X0=8*(AD-1024-40*K)
40 Y0=8*K
50 IF X0>319 THEN NEXT K
60 PRINT"{CRSR DN}VALUES"
61 PRINT"OF X/Y"
62 PRINT"AT THIS"
63 PRINT"ADDRESS:"
200 PRINT"{HOME}"
210 J=0
220 FOR I=0 TO 7
230 X$=STR$(X0+I)
240 PRINTTAB(10+4*I-LEN(X$))X$;
250 NEXT I
260 PRINT
270 FOR K=0 TO 7
280 Y$=STR$(Y0+J)
290 PRINTTAB(10+4*K-LEN(Y$))Y$;
300 NEXT K
310 PRINT:PRINT
320 J=J+1: IF J<8 THEN 220
360 PRINT"{5 CRSR UPs}ANOTHER"
361 PRINT"ADDRESS?"
362 PRINTTAB(2)"Y/N"
370 GET W$: IF W$="" THEN 370
380 IF W$="N" THEN PRINT"{SHFT CLR}":END
390 GOTO 5
```

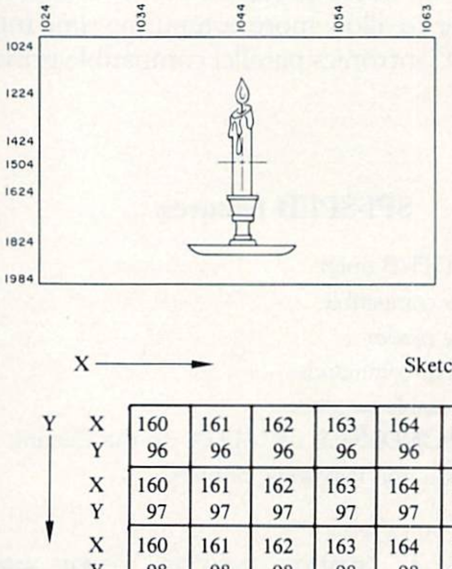
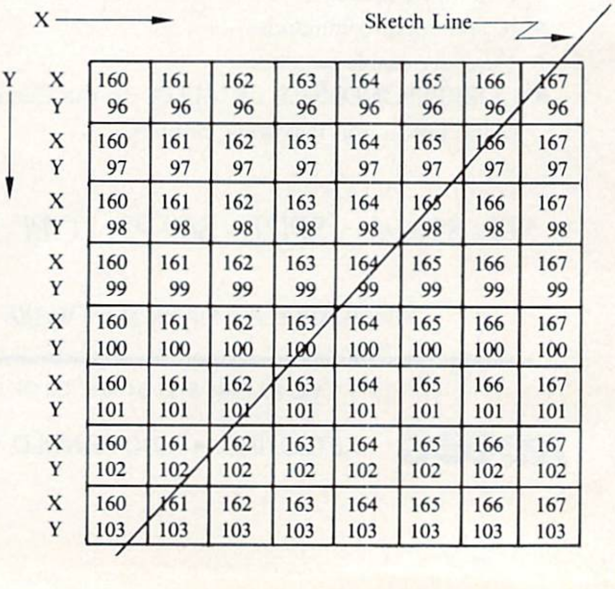


Fig. 1. *Sample high-resolution graphic.*

Fig. 2. *The X and Y coordinates for the dots in square 1524.*



X	160	161	162	163	164	165	166	167
Y	96	96	96	96	96	96	96	96
X	160	161	162	163	164	165	166	167
Y	97	97	97	97	97	97	97	97
X	160	161	162	163	164	165	166	167
Y	98	98	98	98	98	98	98	98
X	160	161	162	163	164	165	166	167
Y	99	99	99	99	99	99	99	99
X	160	161	162	163	164	165	166	167
Y	100	100	100	100	100	100	100	100
X	160	161	162	163	164	165	166	167
Y	101	101	101	101	101	101	101	101
X	160	161	162	163	164	165	166	167
Y	102	102	102	102	102	102	102	102
X	160	161	162	163	164	165	166	167
Y	103	103	103	103	103	103	103	103

Put address numbers around the edges—1024 in the upper-left corner, 1063 in the upper right, etc.—until you can easily find the address number of any square on the sheet (see Fig. 1).

A Utility Program

In Fig. 1, the lines of the subject pass through squares whose screen addresses can be determined. The computer, however, wants the Xs and Ys of the dots.

First, save the program listing you have entered thus far. Write down the filename of the program so you'll have no difficulty reloading later on. When you're finished, type NEW and enter Listing 1. To get the X and Y coordinates of any dot, complete the following steps.

1. Look at Fig. 1. A line of the subject passes through a square. Determine the address of that square (i.e., a number between 1024 and 2023).
2. Run Listing 1. It will ask: ADDRESS? Enter the address you determined above. The program will then give you the X and Y coordinates for all 64 dots in that square.
3. Determine through which dots the line of the subject passes. Those are the dots you want turned on. Note the coordinates, keeping them in order.

For example, let's say that we have a line running diagonally through square 1524. Fig. 2 shows which dots must be turned on for that line to appear on the screen. (By the way, blowups of complicated designs are well worth the effort.)

Type in the following program:

```
100 READ X,Y: IF X = 0 THEN 999
110 GOSUB 1000
120 GOTO 100
130 DATA160,103,161,102
140 DATA162,101,163,100
150 DATA164,99,165,98
160 DATA166,97,167,96
170 DATA0,0
```

Note that the If statement in line 100 tells the computer when to stop reading. Now run the program. A short line should appear in the middle of the screen.

Two things are obvious here:

1. There is great flexibility. It would be very easy to make the line curve any way you wanted.
2. This is a lot of work. Compare this with the much longer lines drawn easily with the For. . .Next loops.

There are four ways to tell the computer which dots to turn on: Read/Data statements, For loops, mathematical equations or combinations of all three.

You could, for example, write a set of program statements for every line, specifying which dots (of the 320 available) to turn on along that line. In this case, you could use For. . .Next loops or Read/Data statements. A Read/Data statement is the only technique suitable if you have irregular shapes; but Read/Data statements tend to be very long and need careful compiling.

In describing the lines of your sketch, then, use the easiest technique possible. Describe straight or geometric lines mathematically, if possible, or use For loops, even for short parts of longer lines. Fill in between with Read/Data statements. R

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FOR THE COMMODORE 64

From Limbic Systems, Inc. – OXFORD PASCAL, developed by Oxford Computer Systems (Software), Ltd., creators of *PETSPEED– the BASIC compiler recommended by Commodore.

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Sprite Delight

By DAVID BREUNIG

If you've ever tried to create a sprite, you know how tedious this can be. This program speeds up the process and makes it a delightful experience.

Sprite Delight is an easy-to-use sprite editor that lets you create your own sprites. Instead of waiting for two hours (which is how long it took me to create Data statements with the demo program in the *User's Guide*), this program lets you make those Data statements in two minutes.

Using the Program

Type in the program (be sure to save it before running it). You can then type RUN and press the return key. The screen will stop for a few seconds, then the main screen will be created.

At the top of the screen, there will appear a window, which will display messages according to the mode you are in. The screen will also display an empty editor graph with a cursor at the home position. There will be pixel (one dot of light on the screen) numberings on two sides of the graph, with three sets of bit numberings appearing on top.

To the right, the cursor position will be displayed. Under that will be the sprite colors, and at the bottom right-hand corner will be the sprite.

Now it's time to start making your own sprite. Using the cursor keys to move around, turn pixels on and off with the plus (+) and minus (−) keys, respectively. (To turn off pixels, you can also use the space bar and delete keys as if you're using the normal screen editor.)

Handy Features

Cursor keys also work when shifted, so you can make vertical lines much easier. For example, press the shift-lock, the plus key (+) and then the two cursor keys, one at a time. Doing this over and over will create a vertical line with ease. You can use the minus (−) key to erase a vertical line.

When you want to see what the sprite will look like, simply press the equals (=) key. The window will respond by asking whether you want the sprite to be made normally or in reverse.

After you answer with an N or an R, the computer will slowly create your sprite. This will take between ten and 15 seconds.

Since it takes such a long time, I added a special feature. If you press the equals (=) key by mistake, you can exit by pressing the return key, but only when you first press it. If it's already creating the sprite, you'll have to wait.

When you push R for the reverse sprite, not only will the sprite become reverse, but so will the graph. If you want to avoid this, you can use O, for opposite. This will give you, as it implies, the opposite of the sprite in the sprite demo box. This takes only a second and can be done again and again to change the sprite from reverse to normal.

After you complete your sprite, you can change its shape; pressing the F3 key will change it vertically

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Commodore 64

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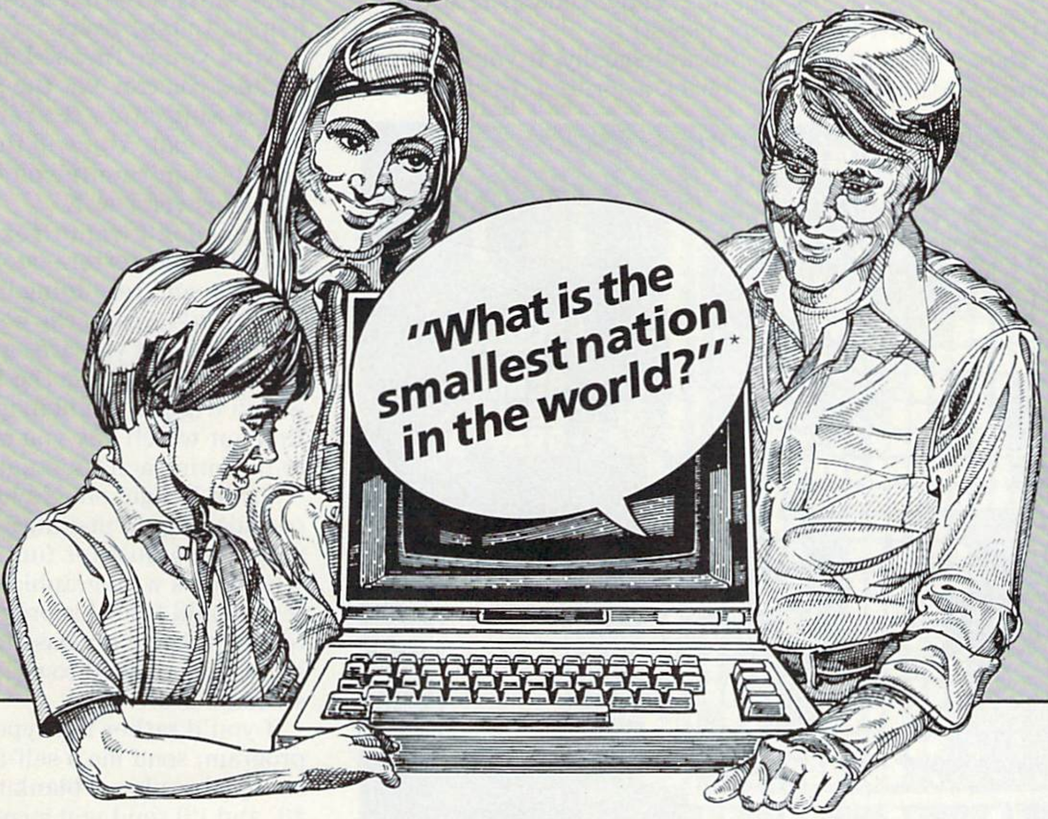
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*The answer is San Marino.

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and pressing the F4 key (shifted F3) will change it horizontally. You can also change the color by pressing F5 and F6 (shifted F5). F5 will change the sprite color and F6 will change its background color.

Yes, there is a solid sprite behind your made-up sprite, so you can try out all 256 color combinations without affecting the screen color. However, if you wish, you may also change the screen color by pressing F1.

Now you have the sprite just the way you want it. Here's the part where it all becomes worthwhile. Press D and you can see the data, which could have taken at least two hours to perfect.

When you copy all the data, it's time to save your sprite for later reference. You do this by pressing S. The screen will clear and you'll be asked for the filename. Then you will be asked whether you are going to save to tape or disk. (There is a D under the cursor for an easy input for disk. This D, in line 112, can be changed to T for tape users.)

Just as logically, if you want to load back a sprite, press L. You will then go through the same questions as you did for saving a sprite.

Saving and Loading Sprites

When a sprite is saved, the graph itself, not the sprite's data, is actually saved. After the loading process is done, you'll have to wait for the sprite to be formed, as though you had pressed the equals key. This speeds up the loading time—a feature that is especially helpful to tape users.

After you're finished making sprites, you can exit the program by pressing either the run/stop key or E, for exit. You will then be asked if you're sure you want to exit. Answer Y or N.

If you don't want to exit, but would rather restore (stopping the program and rerunning it), press {SHFT CLR}. Again, the computer will ask you if you are sure that is what you want. Use the H key, which triggers the help menu, to find out which key you must press to perform each function.

Sprite Delight should help you considerably in making sprites for programs or just for fun. Anyone who draws with graphics characters should find this program easy to adapt, since it's based on the same logic needed to use the screen editor.

If you'd rather not type in the program, send me a self-addressed stamped mailer, a blank tape and $3, and I'll send you a copy of the program.

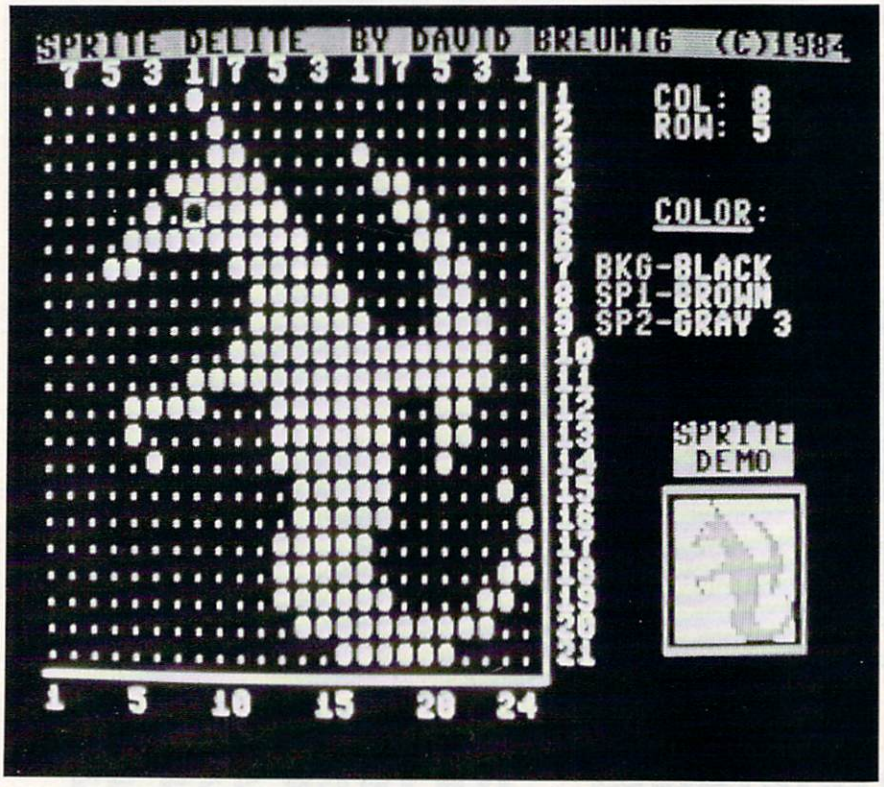

Photo 1. *Main screen from Sprite Delight holds a 21 by 24 editor graph. To its right, your chosen sprite colors are displayed, and below them is the demo box for viewing your newly created sprite.*

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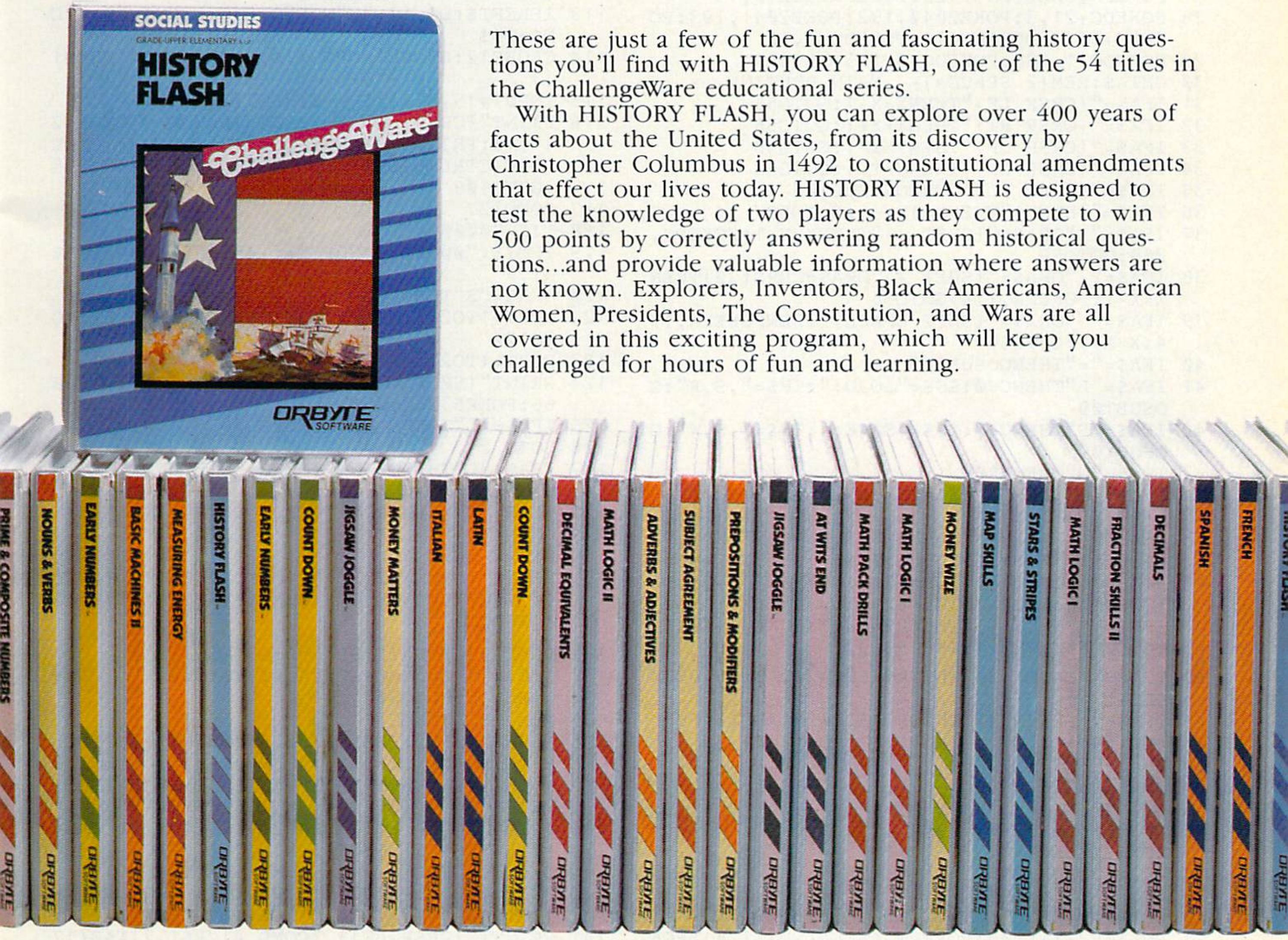
Listing 1. *Sprite Delight program for the C-64.*

```
1 REM INITIALIZE
2 :
3 DC=53248
4 DIMS$(21),CR$(16),K$(17),E$(17):FORT=1TO8
  :READLT(T):NEXT
5 FORT=12288TO12351:POKET,0:POKET+64,255:NE
  XT
6 FORT=1TO21:S$(T)="........................
  .":NEXT
7 PN=1104:FORT=0TO16:READCR$(T):NEXT
8 FORT=1TO17:READK$(T),E$(T):NEXT
10 POKE53280,0:POKE53281,0:POKE650,128:PRIN
   T"{SHFT CLR}"CHR$(8):X=1:Y=1:B1=0
11 B2=PEEK(DC+39)AND15:B3=PEEK(DC+40)AND15:
   GOSUB15:GOSUB16:GOSUB66:GOTO30
12 REM MAKE MAIN SCREEN
13 PRINTCHR$(8):GOSUB66
15 POKE53272,21:PRINT"{HOME}{COMD 4}{CTRL 9
   }SPRITE DELITE{2 SPACEs}BY DAVID BREUNIG
   {2 SPACEs}(C)1984{CTRL 4}":RETURN
16 PRINT"{CRSR UP}{COMD 6} 7 5 3 1{CTRL 5}{
   SHFT -}{COMD 6}7 5 3 1{CTRL 5}{SHFT -}{C
   OMD 6}7 5 3 1{CTRL 4}{8 SPACEs}"
17 FORT=1TO21:PRINTS$(T)"{CTRL 8}"T"{CTRL 4
   }":NEXT
18 PRINT"{CRSR DN}{CTRL 8}1{3 SPACEs}5{3 SP
   ACEs}10{3 SPACEs}15{3 SPACEs}20{2 SPACEs
   }24{CRSR UP}{HOME}"
19 FORT=1944TO1968:POKET,64:POKET+54272,4:N
   EXT:POKET-1,125
20 FORT=1928TO1128STEP-40:POKET,93:POKET+54
   272,4:NEXT:Q=30
21 PRINT"{HOME}{14 CRSR DNs}"SPC(31)"{COMD
   1}{CTRL 9}SPRITE":PRINTSPC(31)"{CTRL 9}
   DEMO ":PRINTSPC(30);
```

Who Invented the Submarine?

Who was the only president to serve more than 3 terms?
The purchase of what state was known as Seward's Folly?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```
22 PRINT"{COMD A}{6 SHFT *s}{COMD S}":FORT=
   1TO5:PRINTSPC(Q)"{SHFT -}{6 SPACEs}{SHFT
    -}":NEXT
23 PRINTSPC(Q)"{COMD Z}{6 SHFT *s}{COMD X}"
   :PRINT"{CRSR DN}{CTRL 8}1{3 SPACEs}5{3 S
   PACEs}10{3 SPACEs}15{3 SPACEs}20{2 SPACE
   s}24{HOME}":PRINTTAB(Q);
24 PRINT"{CTRL 3}{HOME}{2 CRSR DNs}"TAB(30)
   "COL: {COMD 3}1":PRINTTAB(30)"{CTRL 3}RO
   W: {COMD 3}1"
25 PRINT"{HOME}{CTRL 6}{5 CRSR DNs}":POKE21
   1,30:PRINT"COLOR:":POKE211,30:PRINT"{COM
   D 6}{5 COMD Ts}"
27 POKEPN,PEEK(PN)+128:POKEPN+54272,14
28 POKEDC+21,3:POKE2040,192:POKE2041,193:PO
   KEDC+16,3:POKEDC,16:POKEDC+2,16
29 POKEDC+1,185:POKEDC+3,185:RETURN
30 GETA$:REM{2 SPACEs}-- MAIN ROUTINE --
31 IFA$="{CRSR LF}"THENX=X-1:GOTO56
32 IFA$="{CRSR RT}"THENX=X+1:GOTO56
33 IFA$="{CRSR UP}"THENY=Y-1:GOTO58
34 IFA$="{CRSR DN}"THENY=Y+1:GOTO58
35 IFA$="{SHFT CLR}"THENGOSUB100
36 IFA$="{HOME}"THENX=1:Y=1:GOTO59
37 IFA$="+"ORA$="{SHFT +}"THENX=X+1:POKEPN,
   209:GOTO56
38 IFA$="-"ORA$="{SHFT -}"ORA$=CHR$(20)THEN
   X=X-1:POKEPN,174:GOTO56
39 IFA$=" "ORA$="{SHFT SPACE}"THENPOKEPN,17
   4:X=X+1:GOTO56
40 IFA$="="THENGOSUB200
41 IFA$="L"THENC=0:LS$="LOAD:":TF$=",S,R":G
   OSUB109
42 IFA$="S"THENC=1:LS$="SAVE:":TF$=",S,W":G
   OSUB109
43 IFA$="D"THEN180
44 IFA$="O"THENFORT=12288TO12350:POKET,(255
   -(PEEK(T))):NEXT
45 IFA$="{FUNCT 1}"THENB1=B1+1:POKE53280,B1
   :POKE53281,B1:GOSUB66:IFB1>15THENB1=0
46 IFA$="{FUNCT 5}"THENB2=B2+1:POKEDC+39,B2
   :GOSUB66:IFB2>15THENB2=0
47 IFA$="{FUNCT 6}"THENB3=B3+1:POKEDC+40,B3
   :GOSUB66:IFB3>15THENB3=0
48 IFA$="{FUNCT 3}"THENPOKEDC+23,ABS(3-PEEK
   (DC+23))
49 IFA$="{FUNCT 4}"THENPOKEDC+29,ABS(3-PEEK
   (DC+29))
50 IFA$="E"THEN130
51 IFA$="H"THEN135
55 GOTO30
56 IFX<1THENX=24:Y=Y-1
57 IFX>24THENX=1:Y=Y+1
58 IFY<1THENY=21
59 IFY>21THENY=1
60 POKEPN,(PEEK(PN)-128):POKEPN+54272,3
61 PN=1063+X+Y*40:POKEPN,(PEEK(PN)+128):POK
   EPN+54272,14
62 PRINT"{HOME}{2 CRSR DNs}{COMD 3}"TAB(34)
   X"{CRSR LF} ":PRINTTAB(34)Y"{CRSR LF} {C
   TRL 8}":GOTO30
65 REM PRINT COLOR
66 PRINT"{HOME}{7 CRSR DNs}"
67 POKE211,27:PRINT"{CTRL 6}BKG-{COMD 6}"CR
   $(B1)
68 POKE211,27:PRINT"{CTRL 6}SP1-{COMD 6}"CR
   $(B2)
69 POKE211,27:PRINT"{CTRL 6}SP2-{COMD 6}"CR
   $(B3)
70 RETURN
100 REM ? RESET ?
101 PRINT"{HOME}{COMD 4}{CTRL 9}{COMD 5}RES
    ET: ARE YOU SURE ({CTRL 0}Y{CTRL 9}ES/{
    CTRL 0}N{CTRL 9}O)?{11 SPACEs}"
102 WAIT198,255:GETRS$:IFRS$<>"Y"ANDRS$<>"N
    "THEN102
```

```
103 IFRS$="Y"THENRUN
104 GOSUB15:RETURN
108 REM LOAD & SAVE
109 POKE198,0:PRINT"{SHFT CLR}{CTRL 4}{CTRL
     9}"LS$"{35 SPACEs}"
110 CLOSE15:OPEN15,8,15
111 POKEDC+21,0:POKE53280,12:PRINT"{3 SPACE
    s}{CRSR DN}{CTRL 8}NAME: {CTRL 5}";:OPE
    N12,0:INPUT#12,NA$:CN$=NA$
112 D=1:PRINT:PRINT:PRINT"{3 SPACEs}{CTRL 4
    }{CTRL 9}T{CTRL 0}APE OR {CTRL 9}D{CTRL
     0}ISK: {COMD 7}D{CRSR LF}";:INPUT#12,D
    $:PRINT
113 IFLEFT$(D$,1)="D"THEND=8:C=8:CN$="0:"+C
    N$+TF$
114 CLOSE12:CLOSE1:OPEN1,D,C,CN$:IFD=1THEN1
    17
115 INPUT#15,V,V$:IFV=0THEN117
116 PRINT"{CRSR DN}{3 SPACEs}ERROR: {CTRL 2
    }";V$:PRINT"{2 CRSR DNs}{3 SPACEs}{CTRL
     9}C{CTRL 0}ONT?":POKE198,0:WAIT198,255
    :GOTO109
117 GOTO127
118 TI$="000000"
119 IFTI$<"000012"ANDPEEK(145)=255ANDD=1THE
    N119
120 IFA$="S"THEN123
122 FORT=1TO21:INPUT#1,S$(T):NEXT:CLOSE1:GO
    TO124
123 FORT=1TO21:PRINT#1,S$(T):NEXT:CLOSE1
124 PRINT"{SHFT CLR}":GOSUB15:GOSUB16:GOSUB
    66:POKE53280,0
125 IFA$="L"THENOL=81:GOSUB206
126 GOTO30
127 IFA$="L"THENPRINT"{CRSR DN}FOUND "NA$:P
    RINT"LOADING"
128 IFA$="S"THENPRINT"{CRSR DN}SAVING "NA$
129 GOTO118
130 REM ? EXIT ?
131 PRINT"{HOME}{CTRL 9}{COMD 6}EXIT: {CTRL
     0}Y{CTRL 9}ES OR {CTRL 0}N{CTRL 9}O?{2
    4 SPACEs}"
132 POKE198,0:WAIT198,255:GETE$
133 IFE$="Y"THENPOKE1024,0:SYS1024
134 GOSUB15:GOTO30
135 REM HELP MENU
138 POKEDC+21,0:POKE53272,23:PRINT"{SHFT CL
    R}{CTRL 8}{CTRL 9}{12 SPACEs}>> {SHFT H
    }{SHFT E}{SHFT L}{SHFT P} {SHFT M}{SHFT
     E}{SHFT N}{SHFT U} <<{13 SPACEs}"
139 PRINT"{COMD 2}{4 SPACEs}{SHFT K}EY"TAB(
    17)"{SHFT E}FFECT":PRINT"{4 SPACEs}{3 C
    OMD Ts}"TAB(17)"{6 COMD Ts}{COMD 5}"
140 FORT=1TO16:PRINTT"{CRSR LF}) {COMD 4}"K
    $(T)TAB(17)"{COMD 5}"E$(T)",":NEXT
141 PRINTT"{CRSR LF}) {COMD 4}"K$(17)TAB(17
    )"{COMD 5}"E$(17)SPC(21)"COLOR.":PRINT"
    {COMD 7}{2 CRSR DNs}{CTRL 9}{SHFT C}{CT
    RL 0}ONTINUE?{HOME}"
142 GETC$:IFC$<>"C"THEN142
143 PRINT"{SHFT CLR}":GOSUB15:GOSUB16:GOSUB
    66:GOTO30
180 REM DATA MODE
181 POKEDC+21,0:PRINT"{SHFT CLR}{CTRL 9}{CT
    RL 6}SPRITE DATA.{4 SPACEs}{CTRL 0}C{CT
    RL 9}ONTINUE?{17 SPACEs}"
182 PRINT"{CTRL 8}{CRSR UP} SERIES 1"," {CO
    MD 1}SERIES 2"," {COMD 2}SERIES 3"
183 PRINT"{CTRL 8} {6 COMD Ts} {COMD T}","
    {COMD 1}{6 COMD Ts} {COMD T}"," {COMD 2
    }{6 COMD Ts} {COMD T}"
184 C$="{CTRL 8}{COMD 1}{COMD 2}":FORT=1TO6
    3:W=W+1:PRINTMID$(C$,W,1)PEEK(12287+T),
185 IFW=3THENW=0:PRINT
186 NEXT
```

```
187 GETC$:IFC$<>"C"THEN187
188 PRINT"{SHFT CLR}":GOSUB15:GOSUB16:GOSUB
    66:GOTO30
198 REM CREATE-SPRITE MODE
199 :
200 PRINT"{COMD 4}{HOME}{CTRL 9}{CTRL 5}NOR
    MAL OR REVERSE OF SPRITE ({CTRL 0}N{CTR
    L 9}/{CTRL 0}R{CTRL 9})?{6 SPACEs}"
201 POKE198,0:WAIT198,255:GETSP$:IFSP$=CHR$
    (13)THENGOSUB15:RETURN
202 IFSP$="N"THENOL=81:GOTO205
203 IFSP$="R"THENOL=46:GOTO205
204 GOTO201
205 REM FORM SPRITE
206 FM=FRE(0):F=0
207 POKEPN,(PEEK(PN)-128):POKEPN+54272,3:GO
    SUB215:FORC=1TO21:FORR=1TO24STEP8
208 FORD=1TO8:Z$="."
209 IFPEEK(1062+(R+D)+(C*40))=OLTHENA=A+LT(
    D):Z$="{SHFT Q}"
210 Y$=Y$+Z$:NEXT:POKE12288+F,A:A=0:F=F+1:N
    EXT:S$(C)=Y$:Y$=""
211 NEXT:GOSUB15:PRINT"{HOME}{CRSR DN}{CTRL
     4}":FORT=1TO21:PRINTS$(T):NEXT
212 POKEPN,(PEEK(PN)+128):POKEPN+54272,14:R
    ETURN
215 PRINT"{HOME}{COMD 4}{CTRL 9}{COMD 1}FOR
    MING SPRITE AND CREATING DATA.{7 SPACEs
    }":RETURN
900 REM DATA
902 :
910 DATA 128,64,32,16,8,4,2,1
920 DATA "BLACK ",WHITE,"RED{2 SPACEs}",CYA
    N,PURPLE,"GREEN ","BLUE ",YELLOW,ORANGE
930 DATA "BROWN ",LT RED,GRAY 1,GRAY 2,LT G
    REEN,"LT BLUE ","GRAY 3 ","BLACK "
940 DATA "{SHFT C}{SHFT R}{SHFT S}{SHFT R}
    {SHFT K}EYS","{SHFT U}SUAL"
942 DATA "{SHFT I}{SHFT N}{SHFT S}{SHFT T}/
    {SHFT D}{SHFT E}{SHFT L}","{SHFT D}ELET
    E ONE PIXEL"
944 DATA "{SHFT H}{SHFT O}{SHFT M}{SHFT E}"
    ,"{SHFT U}SUAL"
946 DATA "{SHFT C}{SHFT L}{SHFT R}/{SHFT H}
    {SHFT O}{SHFT M}{SHFT E}","{SHFT A}SK F
    OR {SHFT R}ESET?"
948 DATA "{CTRL 9}+{CTRL 0}","{SHFT P}IXEL
    ON"
950 DATA "{CTRL 9}-{CTRL 0}","{SHFT D}ELETE
     ONE PIXEL"
952 DATA "{CTRL 9}={CTRL 0}","{SHFT F}ORM S
    PRITE IMAGE{CTRL 2}"
953 DATA "{CTRL 9}{CTRL 2}{SHFT H}{CTRL 0}"
    ,"{CTRL 9}{CTRL 2}{SHFT H}ELP MENU{CTRL
     0}{COMD 5}"
954 DATA "{CTRL 9}{SHFT L}{CTRL 0}","{SHFT
    L}OAD A SPRITE"
956 DATA "{CTRL 9}{SHFT S}{CTRL 0}","{SHFT
    S}AVE SPRITE"
958 DATA "{CTRL 9}{SHFT O}{CTRL 0}","{SHFT
    M}AKE OPPOSITE IMAGE"
960 DATA "{CTRL 9}{SHFT E}{CTRL 0}","{SHFT
    A}SK FOR {SHFT E}XIT?"
962 DATA "{CTRL 9}{SHFT F}1{CTRL 0}","{SHFT
    C}HANGE {SHFT S}CREEN COLOR"
964 DATA "{CTRL 9}{SHFT F}3{CTRL 0}","{SHFT
    C}HANGE {SHFT S}PRITE HEIGHT"
966 DATA "{CTRL 9}{SHFT F}4{CTRL 0}","{SHFT
    C}HANGE {SHFT S}PRITE WIDTH"
968 DATA "{CTRL 9}{SHFT F}5{CTRL 0}","{SHFT
    C}HANGE {SHFT S}PRITE COLOR"
970 DATA "{CTRL 9}{SHFT F}6{CTRL 0}","{SHFT
    C}HANGE {SHFT B}{SHFT K}{SHFT G}{SHFT
    R}{SHFT D} {SHFT S}PRITE"
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Create Your Own Characters

By TERRY IMLER

Customize the character set on your unexpanded VIC; then let this program translate those characters for use in your own programs.

How many times have you had a good idea for a game program (or even written the program) but were then slowed down by having to make your own character set? And, how many times have you settled for the VIC-20 built-in graphics because it seemed too much work to design your own characters? Well, take heart. Here's a program that will greatly simplify your programming. It's easy to use, and it does almost all the work itself.

The program is designed for the unexpanded VIC. When you run the program, it will ask you if you want to make another character or if you are done. When you choose to make a character, it will display the 64 available, changeable characters on the left side of the screen with an 8 × 8 grid on the right.

All the characters are composed on an 8 × 8 grid of blocks. You will see the grid on the right-hand side of the screen with a rapidly blinking cursor in the form of an asterisk. You use the cursor controls to move the cursor to any one of the 64 blocks. After you position the cursor on one of the blocks, you push the space bar to invert that block. In other words, if the block is lit up, pushing the space bar will turn it off, and if the block is not lit up, pushing the space bar will light it up. Using this technique, you can make your own custom character in the 8 × 8 grid.

After you make the character, press the return key. You will then be asked which character you want to replace. Suppose, for example, that you chose the letter A. The program will go into memory where it has stored the data that tells it how to light up an 8 × 8 grid of dots so as to make the letter A. It will then replace this data with the new data from the 8 × 8 grid of blocks that you just changed on the screen.

Before your very eyes, you will see all the letter A's changing, from top to bottom, until each A looks exactly like a miniature of the character you created on the grid. (Rather than replacing numbers and letters with my custom characters, I prefer to replace the punctuation characters. That way I can still print words and numbers along with my custom characters.)

If you choose to replace letters instead of punctuation marks, I suggest that you commit to memory the simple instructions printed on the screen, as those letters will be converted to custom characters in the instructions, too. For example, if you made a star character, then chose to replace the letter A with it, every word that contains the letter A will have stars in place of the A's.

You can continue this way, changing any or all of the 64 characters to suit your needs. When you are done with each character, you will get the option menu, which says

1 DONE
2 ANOTHER CHARACTER

If you want to create another character, enter 2. If you are

RUN It Right
Unexpanded VIC-20

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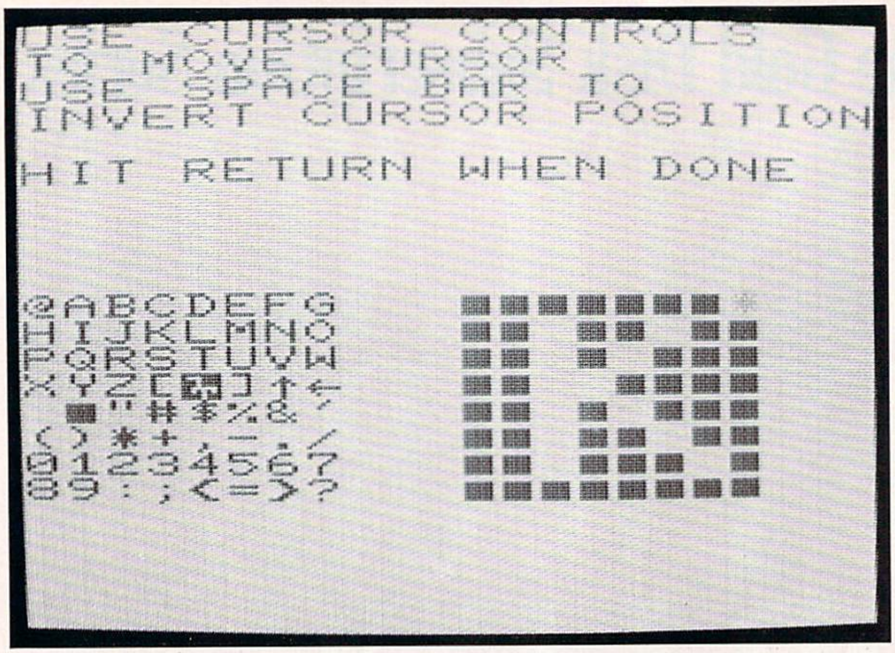

```
USE CURSOR CONTROLS
TO MOVE CURSOR
USE SPACE BAR TO
INVERT CURSOR POSITION

HIT RETURN WHEN DONE



@ABCDEFG
HIJKLMNO
PQRSTUVW
XYZ[£]↑←
■!"#$%&'
()*+,-./
01234567
89:;<=>?
```

Photo 1. *There are 64 available characters for you to custom-design.*

done, enter 1. If you enter 1 by mistake, don't worry. It will then say

ENTER D IF DONE

If you do not enter the letter D, it will return to the option menu. *Special Note:* Make sure you save copies of the program before running it, since it will erase parts of itself.

A New Program

When you enter the letter D (for done), you will see a lot of numbers and characters being rapidly printed on the screen. When the screen finally stops changing and says READY, you're in for a treat. The program will have erased itself. (No need to worry—unless you forgot to save copies). But, before it completely erased itself, it will have written a new program for you.

All the data that was stored in memory to make up the customized 64-character set has been put into Data statements. These Data

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statements will start at line number 105. Lines 100, 101 and 102 will:

1. Reserve the memory needed for the custom character set.
2. Tell the video display chip to get its characters from the new custom character set.
3. Copy the data from the Data statements into the memory that is reserved for the custom character set.

Now you can write your game program, using any of the 64 regular characters (like those you saw displayed in this program). Then use this custom character program to create your personalized characters.

You'll notice (after running the custom character program) that there are no line numbers 103 and 104. This was done intentionally. You could use this omission to add a line number 103 that loads your game program. (For example, if your game program is called GAME 3, then you could add:

```
103 LOAD "GAME 3"
```

What you have, then, is a program that reserves memory for your custom character set, copies your custom character set (from the Data statements) into the reserved memory, tells the VIC to get its characters from the reserved memory (i.e., activates your new customized character set) and then loads and runs your game program.

I had originally decided to save the data for the custom character set as a file on tape, but I changed my mind for one main reason. It's very easy to make a copy of a program, but it's not very easy to make a copy of a datafile.

When typing in this program, type it exactly as shown. Do not change any line numbers, or it will not work correctly. After you've run it, and it has created the new program, don't forget to save the new program with your Data statements.

Having the 64 characters on the left side of the screen gives you some additional options. If you want to make a large character (64 × 64, for example), you can easily do so by using four characters (one at a time) that are grouped around each other, and see exactly what it will look like. The combinations and possibilities of this program are extensive, and I think you'll like the simplicity and ease with which it works. Ⓡ

Address all author correspondence to Terry Imler, 1200 Vine St., Lot 24, Middletown, PA 17057.

Listing 1. *Customized Graphics program.*

```
1 POKE36879,232:POKE52,28:POKE56,28:POKE54,
  28:POKE644,28:CLR
2 FORI=7168TO7679:POKEI,PEEK(I+25600):NEXT
3 POKE36869,255:DIMZ%(8,8)
4 PRINTCHR$(147);"1-DONE"
5 PRINT"2-ANOTHER CHARACTER":INPUTB
6 ONABS(B)GOTO8,27
7 GOTO4
8 S$="":PRINT"ENTER D IF DONE"
9 INPUTS$:IFS$<>"D"THEN4
10 POKE0,1:GOTO58
11 B=PEEK(L):T=TI
12 GETA$:IFA$<>""THEN16
13 IFT>(TI+100)THEN12
14 IFPEEK(L)=42THENPOKE(L),32:T=TI:GOTO12
15 POKEL,42:T=TI:GOTO12
16 POKEL,B:C=ASC(A$):IFC=17THENL=L+22
17 IFC=29THENL=L+1
18 IFC=145THENL=L-22
19 IFC=157THENL=L-1
20 IFC=13THENRETURN
21 IFC=32THEN25
22 IFL<7900THENL=L+22
23 IFL>8080THENL=L-22
24 FORI=0TO100:NEXTI:GOTO11
25 B=32:IFPEEK(L)=32THENB=33
26 POKE(L),B:GOTO11
27 PRINTCHR$(147);"USE CURSOR CONTROLS{3 SP
   ACEs}TO MOVE CURSOR"
28 PRINT"USE SPACE BAR TO":PRINT"INVERT CUR
   SOR POSITION"
29 PRINT"HIT RETURN WHEN DONE":FORI=38620TO
   38840:POKEI,6:NEXT
30 GOSUB43:GOSUB11:GOSUB37:GOSUB31:GOSUB40:
   GOTO4
31 PRINTCHR$(147)
32 PRINT"ENTER THE CHARACTER{3 SPACEs}THAT
   YOU WANT TO BE{3 SPACEs}REPLACED";
33 CH$="A":INPUTCH$:CH$=RIGHT$(CH$,1)
34 CH=ASC(CH$):IFCH<32ORCH>95THEN32
35 IFCH<64THENCH=CH+64
36 CH=CH-64:CH=(CH*8)+7168:RETURN
37 X=1:FORL=7910TO8064STEP22:FORI=1TO8
38 Z%(X,I)=1:IFPEEK(I+L)=32THENZ%(X,I)=0
39 NEXTI:X=X+1:NEXTL:RETURN
40 FORX=1TO8:Y=0:W=1:FORI=8TO1STEP-1:Y=Y+(Z
   %(X,I)*W)
41 W=W*2:NEXTI:POKECH,Y:CH=CH+1:NEXTX
42 FORI=1TO600:NEXTI:RETURN
43 POKE7432,0:FORI=1TO6:POKE(I+7432),126:NE
   XTI:POKE7439,0
44 FORL=7910TO8064STEP22:FORI=1TO8:POKE(I+L
   ),33
45 POKE(I+L-11),((L-7910)*8/22)+I-1:NEXTI:N
   EXTL:RETURN
46 GOSUB61:PRINT"100 POKE36869,PEEK(36869)O
   R15"
47 PRINT"101 POKE52,28:POKE54,28:POKE56,28:
   CLR"
48 PRINT"102 FORI=7168TO7679:READA:POKEI,A:
   NEXTI"
49 GOTO54
50 IFPEEK(0)=32THENPOKE0,44:GOTO62
51 GOSUB61:A=PEEK(0):POKE0,A+1:B=7168+(A*16
   )
52 A=A+105:GOSUB56:PRINT"DATA";:A=PEEK(B):G
   OSUB56
53 FORI=B+1TOB+15:A=PEEK(I):GOSUB55:NEXTI:P
   RINT
54 PRINTCHR$(5);"GOTO50";CHR$(31):GOTO60
55 PRINT",";
56 PRINTMID$(STR$(A),2);:RETURN
57 IFPEEK(0)=>45THENPOKE0,0:GOTO46
58 A=PEEK(0):POKE0,A+5:A$="GOTO57":GOSUB61
59 FORI=ATOA+4:PRINTCHR$(157);I;CHR$(141):N
   EXTI:PRINTA$
60 FORI=631TO640:POKEI,13:NEXT:POKE198,10:P
   RINTCHR$(19);:END
61 PRINTCHR$(147);:FORI=0TO3:PRINTCHR$(17);
   :NEXTI:RETURN
62 A$="GOTO62":IFPEEK(0)=59THENA$="POKE3686
   9,240:POKE36879,27"
63 A=PEEK(0):POKE0,A+5:GOSUB61:GOTO59
70 REM EASY CUSTOMIZED CHARACTER GRAPHICS
80 REM BY TERRY L. IMLER (.VKY)
```

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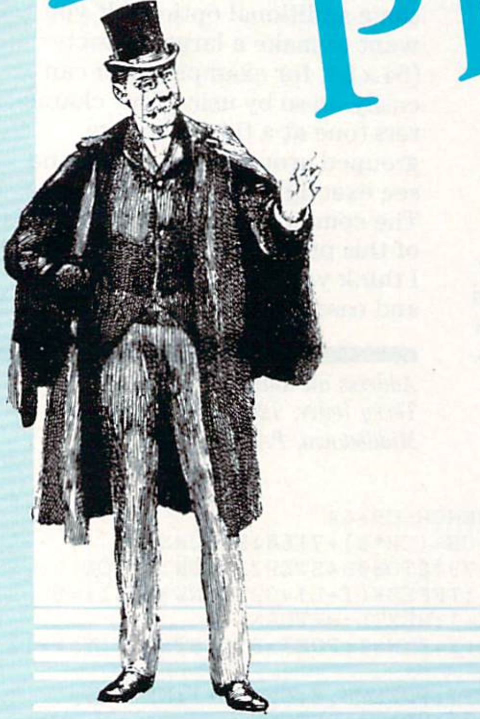

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Picture This...

By DAN MOSEDALE

It's time you drew the line on second-rate graphics. Transform your VIC-20 monitor into a high-resolution graphics tablet, and sketch to your heart's content.

While the VIC-20 is one of the best low-priced computers, it lacks a high-resolution graphics screen.

Various magazines have published articles and programs that create high-resolution graphics screens and produce mathematical figures with them. However, it is impossible to create a picture (a human face, for instance) with one of these programs. You must either spend money on a cartridge or write a very intricate program.

To fill this need, I developed the VIC Hi-Res Painter, which will create a hi-res graphics screen; let you draw a picture from the keyboard; save your picture on tape; and load a picture from a tape.

After you type in the program, run it. The screen will first display a main menu that gives you the following four choices:

1) DRAW PICTURE
2) LOAD PICTURE
3) SAVE PICTURE
4) QUIT

Prepare to Draw

When you type 1, the screen will shrink from 22 × 23 to 16 × 16; it will clear; it will turn purple; and a small white dot (the cursor pixel) will appear in the screen's center. You are now in the Drawing mode. The Y, B, G and H keys move the dots up, down, left and right, respectively. The T and U keys move the dots diagonally up to the left and right, respectively, while the V and N keys move the dots diagonally down to the left and right, respectively. When you push one of these keys, the computer will draw a line in the corresponding direction. The cursor pixel will continue to move until you stop pressing the key.

After some experimenting, you'll probably want to move across the screen without drawing, or delete mistakes. To accomplish either feat, press the F1 key (the cursor pixel will then blink), and use the same direction keys. To return to the Drawing mode, press the F1 key again. To clear the graphics screen and draw another picture, press the home key. To return to the main menu, press the F3 key.

If you would like to save a picture, regardless of whether or not it is finished, return to the main menu and press 3. The computer will then save your picture to a file. A picture uses up quite a bit of memory, so it will take about eight minutes to save.

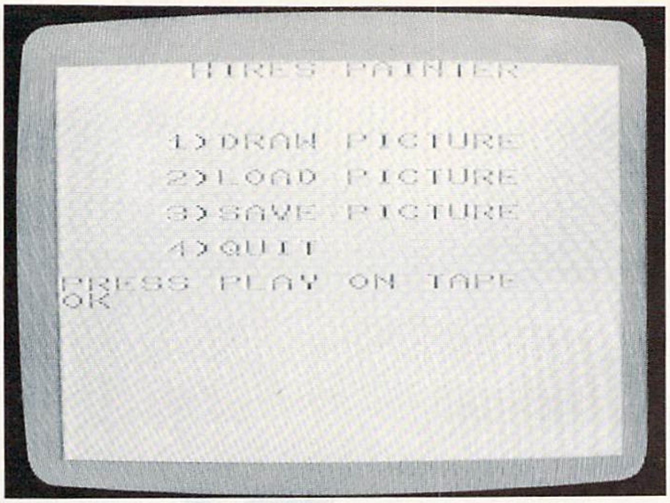
Later, when you want to see

RUN It Right

Unexpanded VIC-20

Listing 1. *VIC Hi-Res Painter program.*

```
10 PRINT"{SHFT CLR}"TAB(5)"HIRES PAINTER":P
   RINT"{3 CRSR DNs}"TAB(4)"1)DRAW PICTURE"
15 PRINT"{CRSR DN}"TAB(4)"2)LOAD PICTURE"
20 PRINT"{CRSR DN}"TAB(4)"3)SAVE PICTURE":P
   RINT"{CRSR DN}"TAB(4)"4)QUIT"
30 GETA:IFA=0THEN30
40 ONAGOTO50,210,220,230
50 POKE650,255:POKE651,1:POKE36866,144:POKE
   36867,32:POKE36864,10:POKE36865,38
55 POKE36869,253:POKE52,20
60 POKE56,20:IFA=1THENGOSUB190
70 POKE36879,44:PRINTCHR$(147)
80 FORL=0TO15:FORM=0TO15:POKE7680+M*16+L,L*
   16+M:NEXT:NEXT:Q=1
90 Y=Y-(A$="B")+(A$="Y")-(A$="N")-(A$="V")+
   (A$="T")+(A$="U")
100 X=X+(A$="G")-(A$="H")-(A$="N")+(A$="V")
    +(A$="T")-(A$="U")
110 IFA$="{FUNCT 1}"THENQ=-Q
120 IFA$="{FUNCT 3}"THEN200
130 IFA$="{HOME}"THENGOSUB190
140 IFX<0THENX=0
150 IFX>127THENX=127
160 C=INT(X/8)*16+INT(Y/8):R=(Y/8-INT(Y/8))
    *8:B=5120+8*C+R:I=7-(X-INT(X/8)*8)
170 POKEB,PEEK(B)OR(2{UP ARROW}I):IFQ=-1THE
    NPOKEB,PEEK(B)-(2{UP ARROW}I)
180 GETA$:GOTO90
190 FORI=5120TO7679:POKEI,0:NEXT:X=63:Y=63:
    RETURN
200 POKE36866,150:POKE36867,174:POKE36864,5
    :POKE36865,25:POKE36869,240:POKE36879,2
    7
205 GOTO 10
210 OPEN1,1,0:FORI=5120TO7679:INPUT#1,Z:POK
    EI,Z:NEXT:CLOSE1:GOTO50
220 OPEN1,1,1:FORI=5120TO7679:Z=PEEK(I):PRI
    NT#1,Z:NEXT:CLOSE1:GOTO10
230 END
```



```
        HIRES PAINTER

    1)DRAW PICTURE

    2)LOAD PICTURE

    3)SAVE PICTURE

    4)QUIT

PRESS PLAY ON TAPE
OK
```

Photo 1. *Main menu from the VIC Hi-Res Painter program.*

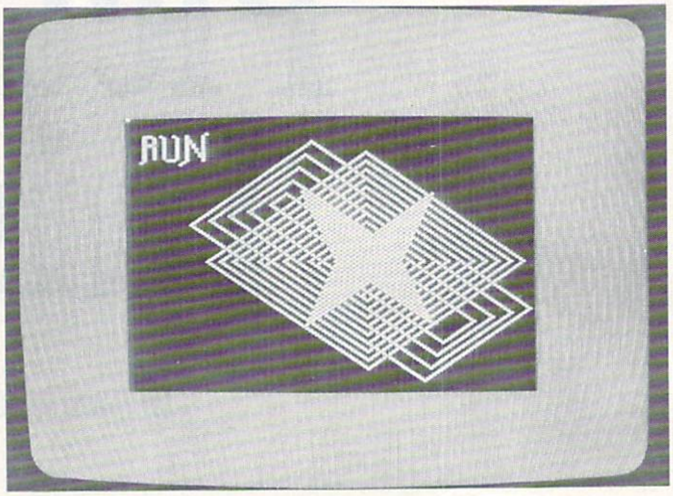


Photo 2. *You'll be pleased at the intricate detail you can achieve while using this program.*

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your picture again, load and run the Hi-Res Painter program, then press 2. Your picture will be taken out of a file and loaded into the computer. After about eight minutes, it should reappear on the screen. The cursor pixel will be in the upper left-hand corner, and you may now continue to draw or make any adjustments.

Note that if you enter the Drawing mode, return to the main menu, and immediately enter the Drawing mode again, several dots will appear in the lower left corner of the hi-res screen. Depending on which key you press, they will draw different patterns of straight lines. You may wish to experiment with them, creating unusual patterns for a while. Once you wish to return to regular drawing, just press the run/stop and restore keys, and type RUN again.

Technical Lines

For those of you who would like to understand how the program works, here is a brief explanation. (If you don't already understand how a high-resolution graphics screen is created, see the *Commodore VIC-20 Programmer's Reference Manual*, or read "VIC Bitmapping," by C.D. Lane, in the July 1983 issue of *Compute*! magazine. After the first two lines, which print the main menu, you come to the main part of the program.

Line 30. Asks for your choice from the selections on the main menu.

Line 40. Directs the computer to the correct selection.

Line 50. The beginning of the Drawing mode. It formats the screen to 16 × 16 characters, tells the computer to take the character set from memory locations 5120–7679, and executes one of the Pokes that sets the limit of Basic.

Line 60. Finishes setting the limit of Basic and checks to see whether a picture has just been loaded in. If not, the computer executes a routine that clears the character set that will be used in the bitmapping of the screen.

Line 70. Sets the screen color and clears the hi-res screen.

Line 80. Pokes one character into each spot on the screen.

Lines 90–100. Add or subtract from the X and Y coordinates, in accordance with the key you have just pushed.

Line 110. Checks to see whether you have pressed F1.

Line 120. Checks to see whether you have pressed F3.

Line 130. Checks to see whether you have pressed the home key.

Lines 140–150. Make sure that you don't go off the horizontal boundaries of the screen.

Line 160. Calculates which bit, in which memory location, to turn on.

Line 170. Turns on the bit, and if you are in Erase mode, turns it off again.

Line 180. Checks for input from the keyboard and loops back to line 90.

Line 190. The subroutine that clears the character set and sets the X and Y coordinates.

Line 200. The subroutine that is executed after you have pressed F3. It sets the screen back to normal and returns to the main menu.

Line 210. The loading routine. It pulls about 2500 numbers (which represent the saved picture) out of a tape file and Pokes them into the character RAM.

Line 220. The saving routine. It Peeks about 2500 numbers (which represent the picture) out of the character RAM and saves them to a tape file.

If you enjoy programming, you might want to try modifying the Hi-Res Painter to work with a joystick or a disk drive.

This program proves that you can still have great graphics without having to invest in a cartridge!

Dan Mosedale (13125 SW Cavalier Court, Beaverton, OR 97005) is a 14-year-old ninth-grader who has been involved with computers for about five years.

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Do's and Don'ts *Of Computer Use*

By JOE ROTELLO

If you have recently purchased, or plan to purchase, a new Commodore home computer, or, perhaps, lucky you, you have received one as a holiday present, then you'll want to heed these tips on how to set up your micro system and keep it humming.

Before you install your first home computer or upgrade an existing system, it is important to consider the environment in which the micro will operate. You should ask yourself and answer the following questions before you set up your microcomputer.

1. What am I using the computer for?
2. Where will my micro be located, and what precautions should I take to ensure a successful installation?
3. How and where will the accessories and supplies be located?
4. What happens when I want to change or expand the existing setup?
5. How can I limit data and financial loss should the unthinkable happen?

Home computer users defend their lack of computer planning by saying, "It's not worth the extra planning" or "I can always take care of those items later." Funny how many times we wish that we had taken that extra hour or so for planning, and how "later" never really seems to come in today's rush world.

Purpose

The reason you selected your Commodore computer in the first place plays an important part in the entire computer installation. For example, was it for a home use like database interfacing or an educational aid for the kids? Different purposes may dictate a different approach to questions 2–5.

How use affects installation is, perhaps, best described by a couple of choice situations. For example, if you use on-line database services like CompuServe or The Source, you must have access to one or more telephone lines now or in the future.

If you plan to expand your system with floppy or hard disk drives, printers, plotters and other accessories, you will have to accommodate these items, as well as paper, disks, power outlets and other required basics.

If you have little or no idea why you bought your Commodore micro in the first place or how you intend to use it, how can you effectively plan for it? Once you define the computer's purpose, only then can you proceed to the next area of concern.

Provisions

Items you might consider under the heading of provisions include general location, ventilation/heating/cooling systems, proper lighting and flooring, computer furniture and availability of sources of clean electrical power and telephone lines.

The very first step is to size up the overall room or area where the computer system will be located. Questions to ask yourself regarding location include:

1. Will I have sufficient working room, especially if I add to the system later? What about sufficient storage room for supplies?
2. Is the area well-lighted, but not so brightly lighted that glare off the video or TV screen will become a problem? Is the area cooled/heated to the extent that the computer (and you) will not overheat, freeze or suffer from lack of sufficient ventilation?
3. Are there sufficient electrical outlets? What about other household appliances? Are any outlets

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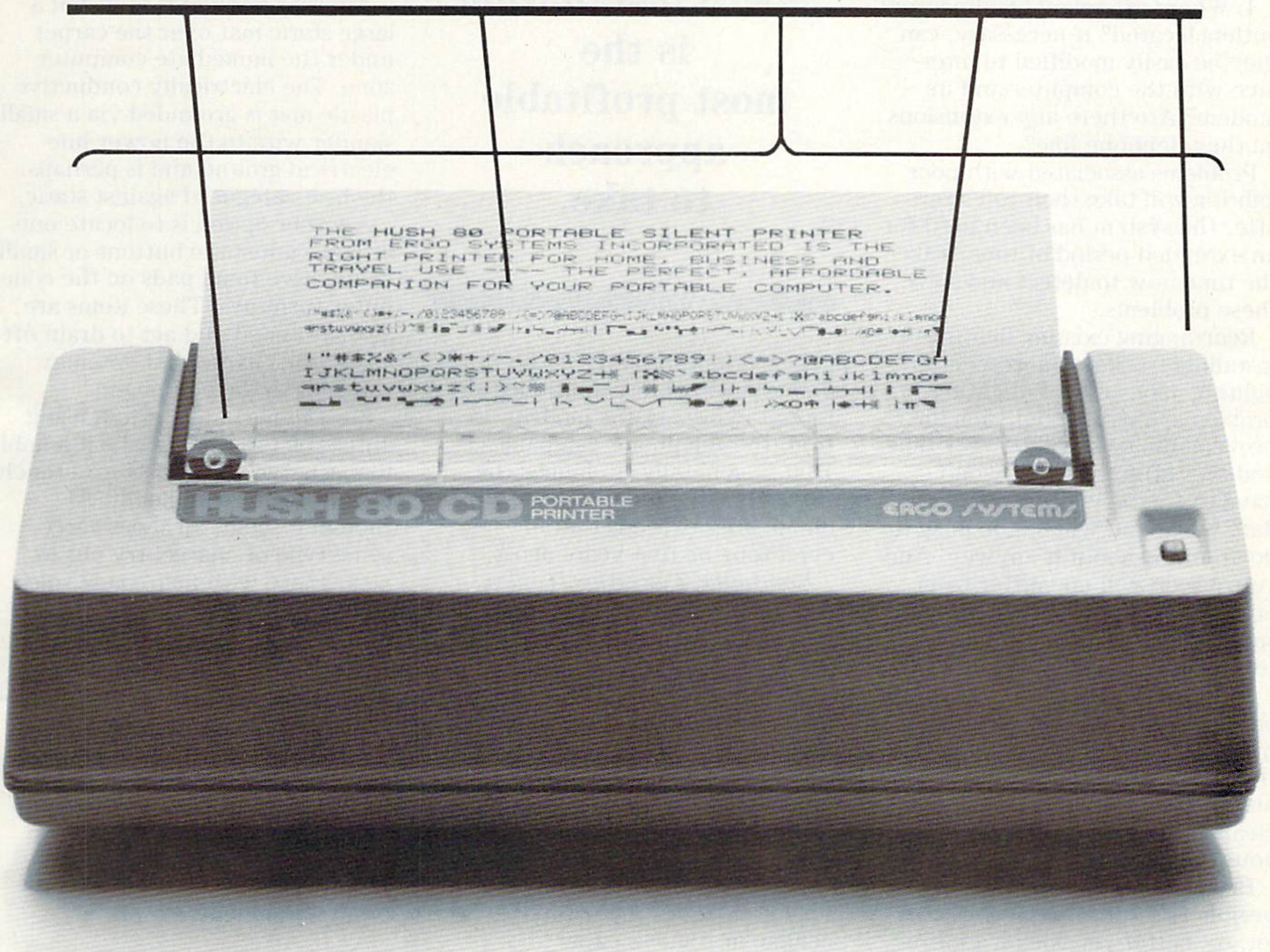
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in the computer area shared with any other electrical noise-producing machines like air conditioners, heating devices or universal motor-driven devices like sewing machines?

4. Where are telephone lines and outlets located? If necessary, can they be easily modified to interface with the computer and its modem? Are there any extensions on the telephone line?

Problems associated with poor lighting will take their toll later, after the system has been used for an extended period of time. Take the time now to detect and solve these problems.

Rearranging existing lighting or installing track or fluorescent lighting may solve the lighting problems. Carrying out such improvements now will be very time- and cost-effective. You won't have to fix the lighting at a later date when you will be too busy to do anything about it anyway. And your vision will not suffer from poor lighting and many hours spent squinting at the computer terminal.

Problems such as lost data, periodic computer shutdowns and the like can be avoided if you take the time to survey the area, its power outlets, and the prospects for clean power before setting up your Commodore.

Be sure to put each computer or peripheral on its own power outlet, or, better yet, install a multiple power outlet so that each item has its own outlet, yet the entire system can be controlled from one master switch. You might also consider purchasing a low-cost power-line conditioner to reduce or eliminate any power-line problems.

Speaking of Telephones. With the ever-increasing use of telephone modems, it pays to take a close look at how your telephone relates to the computer system. Place the telephone in a convenient spot and try to have a private, non-extension phone line. (Picking up an extension phone will terminate your computer data transmission.)

(Please note: The higher-speed 1200-baud modems work with standard phone lines such as those feeding most homes, even though the modem data speed itself has been increased. In the past, such high-speed modems only worked properly if the phone lines were conditioned or rented expressly for modem use from the telephone companies. That is generally no longer the case, since the technical quality of phone lines exceeds that of even four or five years ago.)

Preplanning your micro installation is the most profitable approach to take.

Computer Furniture/Tables. Next, consider the following questions before installing tables or computer work stations:

1. Is the table and video monitor platform at a proper and comfortable working height? Is the table area large enough for the micro, video monitor, printer, disk drive and other accessories that you will be using?
2. Is the printer within easy reach to connect cables and change or remove paper?
3. Are the tables sturdy? Will they support at least 35 percent more weight than they look like they will?

In short, be sure to get firm, well-assembled furniture. It does not have to be expensive, just well-connected and sturdy once assembled. Don't ever overload a piece of computer furniture regardless of how well it may seem to be constructed.

Always plan for computer furniture expansion. Someday—and a lot sooner than you think—you are going to add to your setup. Don't run out of table room today for something that you will do tomorrow.

Flooring. Computers are remarkably sensitive to static electricity. The type of flooring that you use is very important to the life of your micro setup (not to mention your sanity).

Cushioned vinyl flooring is quiet, attractive and easy to care for, but expensive. Carpeting composed of naturally low or non-static material can be used as an alternative.

Another method is to install a large static mat over the carpet under the immediate computer zone. The electrically conductive plastic mat is grounded via a small slender wire to the power line electrical ground and is perhaps the best safeguard against static.

Another option is to locate one or more antistatic buttons or small conductive foam pads on the computer furniture. These items are also grounded and act to drain off any static charge that you may transmit to the equipment.

Most importantly, when using antistatic products, make it a habit to discharge yourself before touching a piece of equipment. Although it seems all shoes carry some type of charge, try not to wear those with man-made soles of smooth or hard rubber. They seem to be the worst as far as static is concerned. On the other hand, Hush Puppy or other similar soft-sole shoes seem to be best.

I do not recommend the use of antistatic spray except in emergency cases. The effectiveness of the spray is temporary, and the dry chemical mist can sometimes find its way into disk drives or other equipment.

Accessories and Supplies

Computer accessories and supplies like paper, disks, printer ribbons and other material form the lifeblood of any micro system. Bad supplies can lead to computer self-destruction.

First, take a good look at how and where you will store unused paper, blank disks, tapes and new printer ribbons. A clean, fairly cool, dust-proof storage environment for these supplies is essential, not only to the proper operation of the paper and disks, but also to the proper overall operation and well-being of your micro equipment.

Properly covered disks, preferably in their own sleeves and boxes, should be able to stand up on shelves or in drawers. Excess paper should be covered or boxed and stacked vertically so as not to curl or bend.

Operational procedures play an important part in the successful setup and operation of your Commodore. Use this computer do's and don'ts checklist to ensure that both computer and you operate without breakdowns.

Do. . .

☐ Provide adequate natural or fan-forced ventilation for your micro system.

☐ Keep new and in-use disks and tapes away from any magnetic source.

☐ Vacuum on a regular basis, keep unnecessary windows closed and cover equipment when not in use.

☐ Quit banging on the keyboard.

☐ Use computer disk and other components as if they were the last ones in the world.

☐ Get the user manual out of the garbage, read it at least once and keep it within reach.

☐ Maintain or have inspected at regular intervals any part of the micro system subject to any wear and tear.

☐ Select chairs and desks so that you do not tire quickly or have to squint at the video display.

Don't. . .

☐ Store or operate your Commodore system in heat or direct sunlight.

☐ Store disks and tapes near motors, telephones or other magnetic sources.

☐ Allow accumulation of dust or smoke particles to collect on or near your micro.

☐ Bang on the keyboard.

☐ Fold, spindle or use for dart practice any computer disk or other component.

☐ Use any new equipment without reading the user's manual at least once.

☐ Let disk drives, printers or keyboards get dirty or stay broken too long.

☐ Use uncomfortable chairs or desks that are of improper height.

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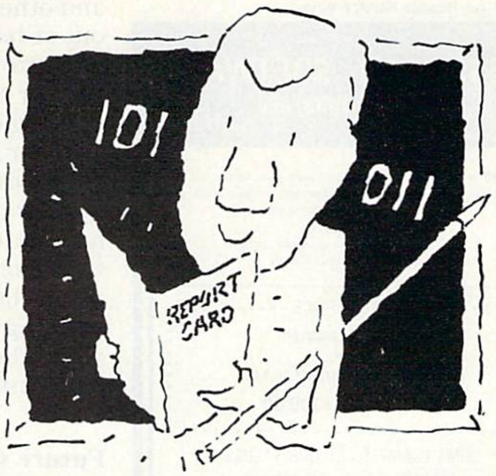

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To keep printer ribbons, tapes and other accessories from drying out or being contaminated with dust, store them in sealed plastic bags or other moisture-proof packaging.

Never store computer hardware, accessories or supplies in the sunlight or near a wall or space heater. It seems that just about anything connected with or to computers has a nasty habit of not wanting to cooperate, especially when their ambient temperature is in excess of 125 degrees.

Future Changes

If you have carefully planned and executed your Commodore computer installation, changing, expanding or adding to your setup should now be far easier to accomplish.

Let's review the areas to be concerned with when it comes time to expand:

Computer furniture—Expansion requirements here generally consist of adding tables or other required platforms. Keep in mind that the structural integrity of the furniture is more important than the looks. Also, peripheral equipment has to be easy to reach.

Power outlets—Plan for additional power outlets. When you expand your setup, you'll simply tap into these outlets.

Accessories—Keep in mind the proper placement of new equipment and other accessories or supplies. Also, follow good electronic practices when routing power and signal cables. And ensure proper ventilation for the new items, especially if the equipment has to be stacked on top of or under your existing setup.

Safeguards

As surely as the sun rises, cats meow and computers compute, you will come face to face with the unthinkable. In fact, think of this as "The Day After," but in a more computer-oriented sense. In this light, the following caveats cannot be repeated often enough:

1. Always have complete and accurate receipts and records of model and serial number, date of purchase and replacement costs for every piece of computer hardware and software.

The effort you spend compiling accurate data regarding dates, prices paid and other individual data on your Commodore is small compared to the time, lost data, worry and money involved should you have to prove a purchase or verify a serial number at some future date.

2. Make many copies of this data, keep it up-to-date and store one copy at the microcomputer site, another elsewhere in your home and a third copy at your bank or other safe-storage facility.

3. Do not store this data only in a computer file!

4. If you ever generate important computer-based data, especially if the data is critical to your home life, always make sufficient backup copies and store them as you would the above non-computer-generated data.

5. Handle the micro setup, accessories and disks as if they were the last ones in the world. You don't have to go overboard, but if carefully treated, the system and its data should last longer than your car.

In fact, following the above steps may well be the only thing more important than your subscription to *RUN*.

Epilogue

In conclusion, installing, upgrading or moving a Commodore home computer may take more work and thought than you originally anticipated.

As you have probably noticed, the main recurrent theme of this article is indeed a simple one: Preplanning your micro installation is the most time- and money-profitable approach to take. Taking the time to survey, arrange and rearrange before you proceed may save you lost time and frayed nerves later on.

The rewards for putting out that extra effort now will eventually be converted into dividends. You may have to wait an extra day, pay an extra dollar or build an extra project, but, in the long run, isn't it really worth it? R

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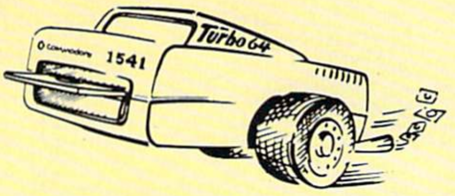

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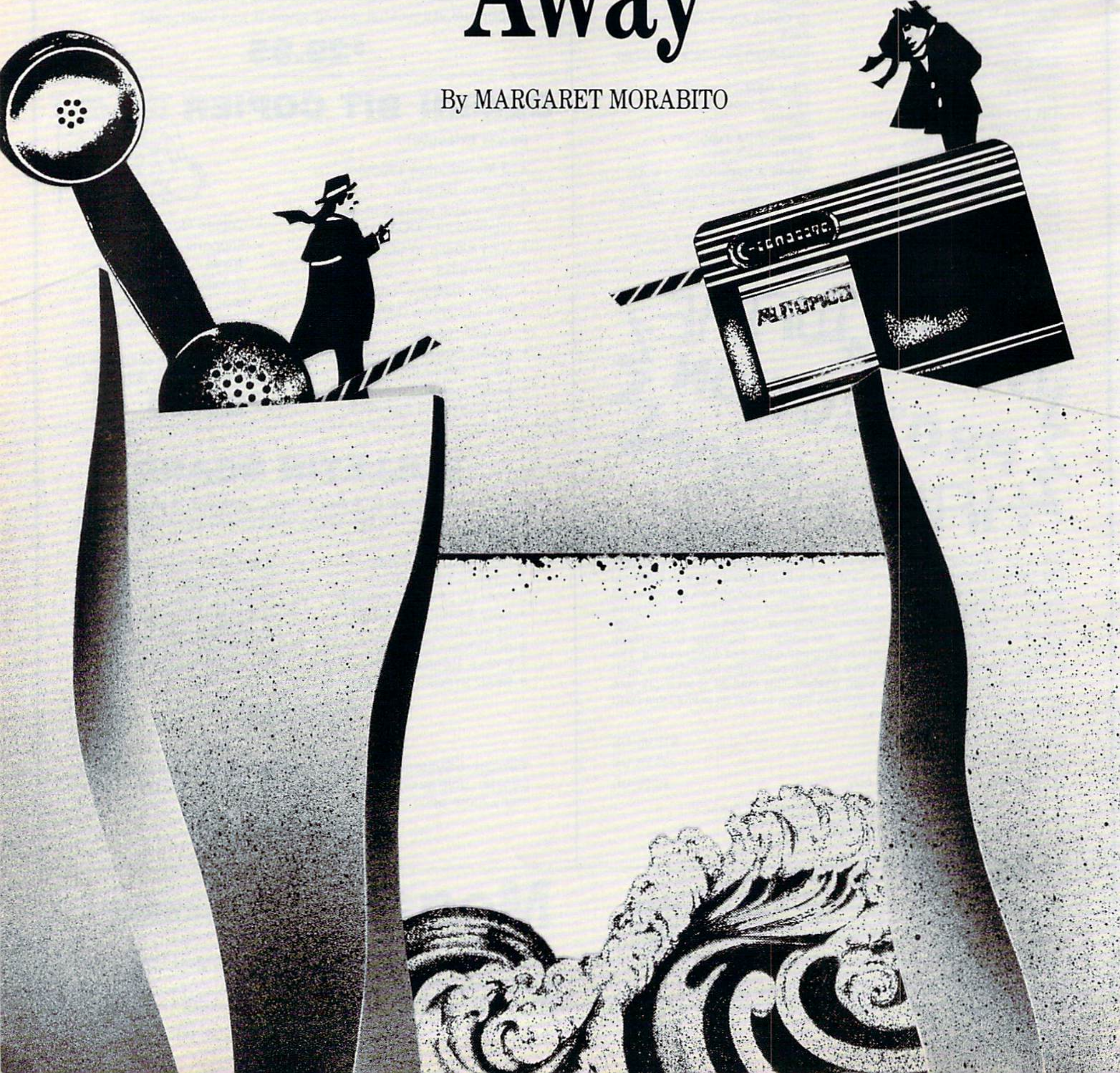
It's Only a Modem Away

By MARGARET MORABITO



The growth of magazine advertisements on terminal software and modems has probably piqued your curiosity about telecommunications. You might even be interested enough in this aspect of computing to want to purchase the necessary peripherals. Before you act, however, here are some things you should know.

Terms, Networks and Modems

First, I will familiarize you with the common terminology associated with telecommunications and discuss two major types of information networks that you are likely to encounter.

When a computer is connected to another computer via telephone lines, it is said to be on-line. A *modem* (*mo*dulator-*dem*odulator) is a device that allows two computers to go on-line by taking one computer's electronic impulses in the form of 0s and 1s, translating them into modulating signals that a telephone can understand, and then demodulating, or retranslating, them back into electronic digital impulses that the other computer can understand. The two computers needn't be the same brand or size.

A *terminal program* is the software needed to run a modem. There are two kinds of terminal programs: dumb and smart.

The terminal programs provided with Commodore's modems are dumb, which means they can send out words and display incoming messages, but they cannot process the information, so you can't print out what you receive or save it onto a disk. When you're a beginner, this is not a crucial problem, because you are learning the ropes and probably just browsing. You can, of course, take notes on paper as a record of the information you do receive.

A smart terminal program, on the other hand, allows you to save information to a disk, to tape or on your printer. It opens up your computer's RAM memory for storage of incoming information. This storage area is the *buffer*. *Uploading* is when your computer is sending a program or file to another computer's buffer. *Downloading* is when your computer is receiving this information from another computer. Both of these can only be accomplished if you have a smart terminal program. As you proceed in your telecommunications career, you will undoubtedly want the luxury of a smart terminal. (See *RUN*, September 1984, "Terminal Programs" by Jim Strasma.)

This article provides you with some basic information about telecommunications and the how-to's of using the Commodore 1600 VIC-Modem and 1650 AutoModem, including how to log on to CompuServe and the Dow Jones News/Retrieval Service.

A packet-switched network is a telephone network that handles communications between different kinds of computers. If you subscribe to a national information service, you will be given the phone number of a packet-switched network in your geographical area (called local node). This cuts down on your phone bill, as you needn't pay for a long-distance call to the *host computer*, but only the phone bill to the local packet-switched network. If you're close enough to your local number, your call might even be toll-free. Tymnet and Telenet are two such networks. (The how-to's of this article are based on Tymnet connections.)

The host computer, or mainframe, is the individual computer that you will ultimately tap for your information. *Connect time* refers to the rate charged by national information systems when you are on-line with their host computers.

Available Services

Informational on-line systems are both national and local. National information services are available nationwide through the use of packet-switched networks. Such services are CompuServe (CPS), the Dow Jones News/Retrieval Service (DJNS), and The Source. You are charged according to whether or not you are using the service during prime time (8 AM–6 PM), which is much more expensive than any other.

RUN It Right

Commodore 64 or VIC-20
Auto-Modem or VIC-Modem

The local bulletin board services (BBSs) are popping up all over the world. (*RUN* will be publishing a list of BBSs in an upcoming issue.) A BBS provides free service, is operated by a system operator (SYSOP, who is an individual home computer user), and it can usually handle only one caller at a time. (See *RUN*'s June 1984 issue on telecommunications.)

Before you buy a modem, make sure that it will connect up to your telephone. Commodore makes it clear that you need a modular phone. What they don't make clear is exactly what *kind* of modular phone you will need. For the VIC-Modem, you will need a modular telephone, wall or desk, push button or dial, that can be disconnected by a plug at the handset. The 1650 Auto-Modem, on the other hand, only requires a telephone that unplugs from the wall. Both the VIC-Modem and the Auto-Modem will work with either the C-64 or the VIC-20.

The Commodore modems are easy to use. You should, however, be aware of their six settings, although you won't normally be changing most of them. The first two are the *duplex* and *answer-originate* settings.

Most of your communication will require Full Duplex mode. On the VIC-Modem, this is preset from within the menu of the terminal program provided with the modem; on the Auto-Modem, this is set by a switch on the modem. You wait for a call in the Answer mode; you make a call in the Originate mode. You usually will be the originator. On the VIC-Modem, this is preset in the menu; on the Auto-Modem, flip the switch on the modem to O. Once you have established yourself as either the originator or the receiver, don't change modes in mid-conversation; you can send and receive in either mode.

For communication on the national networks, the next four settings are ones that you won't ordinarily be changing: speed, word length, stop bits and parity. The *speed* of transmission for the

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Commodore modems will be set to 300 bps (bits per second). *Word length*, which refers to the number of bits used to form one character (not the number of characters per word) will be set to 8. *Stop bits*, signals that tell the answering computer it has just received all the bits needed to form a single character, will be set to 1. *Parity*, used by computers for error checking, will be set to "none."

The actual preparation of your computer and modem for going on-line is relatively easy. However, what you do *after* you've been connected can get complicated if you are not prepared. To begin, you will need:

1. A computer—either C-64 or VIC-20
2. A Datassette recorder hooked to your computer
3. A modem—either VIC-Modem (1600) or 1650 Auto-Modem
4. The terminal program on tape that comes with the modem
5. A modular telephone
6. A TV set or monitor
7. Patience

Setting Up the VIC-Modem

To prepare your VIC-Modem for going on-line, first be sure the power is off; then push the VIC-Modem into the user port. Once you have the modem in place, turn on the power to your monitor and computer. Be sure that your Datassette is connected, too. Don't worry about the telephone yet; just have it nearby. Push back the switch on the right side of the modem. This is for Originate mode. Load the terminal program from the cassette into your computer by typing LOAD "64 TERM" or LOAD "VICTERM I", depending on your computer. You will see on your screen:

```
SEARCHING
FOUND 64 TERM (or VICTERM I)
LOADING
```

After the terminal program has loaded, the screen will prompt READY, at which time you type RUN and press the return key. A copyright message will flash, followed by TERMINAL READY, which will appear on the upper left of your screen. If you're not contacting a national information system, you may need to access the terminal program menu by pressing F4 and making the appropriate changes.

As mentioned previously, the menus are preset for the national information systems. To change a setting, press the first letter of the menu selection that you want changed; the bar highlighter will move vertically to cover the line of your choice. The cursor-right key moves the cursor horizontally. Press the return key after any change. Press T to return to the Terminal Ready mode.

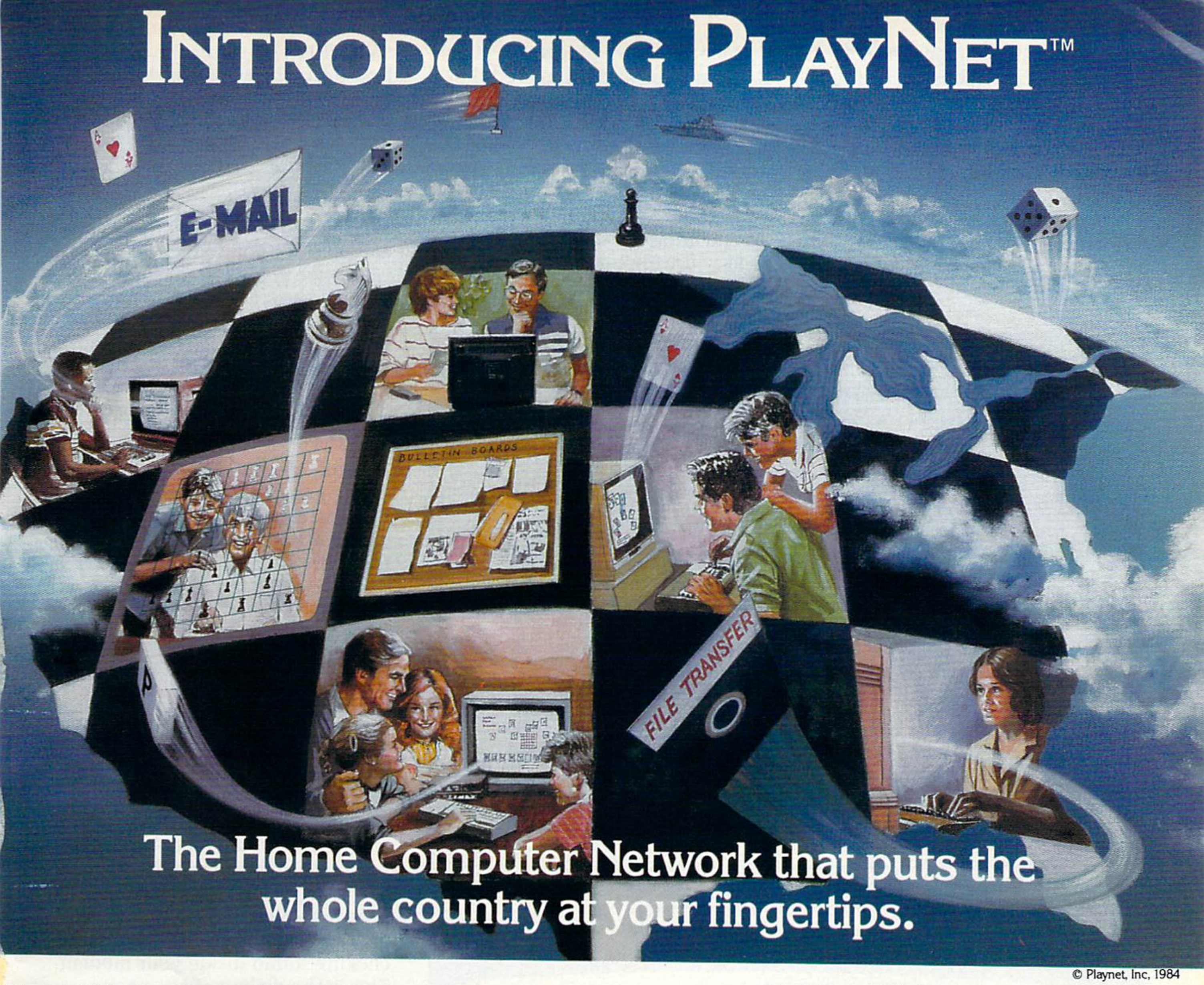
With TERMINAL READY displayed on your screen, dial your local node. You'll either hear the sound of a regular telephone ring or a busy signal. If it's busy, hang up and try again. It is common to have to dial several times before getting through. You will know that the other computer has picked up its receiver when you hear a high-pitched sound in your earphone.

When you hear this sound, unplug the wire from your telephone's handset, but don't hang up the receiver. Plug the wire into the back, left-hand side of the modem. This is the only awkward part of using the modem, but it becomes easier through practice. With the phone wire plugged in, the red light on the right side of the modem will shine, informing you that your computer is ready to talk to the other computer. You can then begin signing on and logging in for the particular service you are accessing. The procedure for signing on to CPS and DJNS will be covered later.

Setting Up the Auto-Modem

Commodore's 1650 Auto-Modem (approximately $100) is by far the better modem of the two. If you have a choice, buy the Auto-Modem, even if it means waiting a little longer in order to save up the extra $40. For the price, the ease of use will tremendously benefit you and make telecommunicating more fun.

First, with the computer off, plug the Auto-Modem into the user port of your VIC-20 or C-64. Unplug your phone wire from the wall oulet and plug it into the modem socket marked "phone." Next, plug the six-foot cable, supplied with your modem, into the wall socket and into the modem socket marked "line." You may leave your phone connected to the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Card #____________ Expiration date______

Signature____________________

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modem all the time; just be sure that the D-T switch is pushed to the T side (for telephone) when you are not using the modem. I find this very convenient. I don't have to bother unplugging and replugging phone wires, as with the lower-priced VIC-Modem. Just type in the phone number on your computer's keyboard whenever you are going on-line.

Once you have plugged in your Auto-Modem and connected the cables, turn on your monitor and computer. Have your Datassette connected, as the Auto-Modem terminal software is also provided on tape. When everything is turned on, and you have your phone numbers easily accessible, load your terminal program by typing LOAD "TERM 64" or LOAD "VICTERM I". After the program has successfully loaded, type RUN. The screen will clear and the following will appear:

```
Terminal Ready
Disconnected
Terminal Ready
```

This means that the phone lines are clear for you to make a new call. Once you have this on your screen, press F6 on your computer. This will clear your screen and display the following instructions in mid-screen:

```
Move T-D to D
Move O-A to O
Input phone number:
```

Unlike the VIC-Modem, you are given on-screen instructions along the way that prompt you for your next step. Follow these by flipping the switches on your modem.

Now type in the phone number of the local packet-switched network or bulletin board that you wish to access. Input the numbers on the keyboard without any parentheses, spaces or dashes, just as if you were making a regular phone call, whether local or long distance. As you type the numbers, they will appear on the screen. Press the return key when finished. Wait a moment.

Underneath your phone number, a duplicate number will appear, one digit at a time. As each digit appears, there will be a faint clicking sound inside your modem. This is the dialing of the phone number. If you don't make a direct connection, your phone number will disappear from the screen, and the instructions will be displayed again, waiting for you to input the phone number. Be patient; the line is busy. Don't worry that you are doing something wrong. As long as you enter the number with no spaces, and with a 1 if it is long distance, then it will eventually work.

When a connection is made, the red light on the front left side of your modem will shine, the screen will clear and the following will appear:

```
Terminal Ready
Date
Host Name:
```

This starts the actual sign-on procedure. Be prepared to act quickly. On my first try, I dialed many times before I got connected, and then when I finally

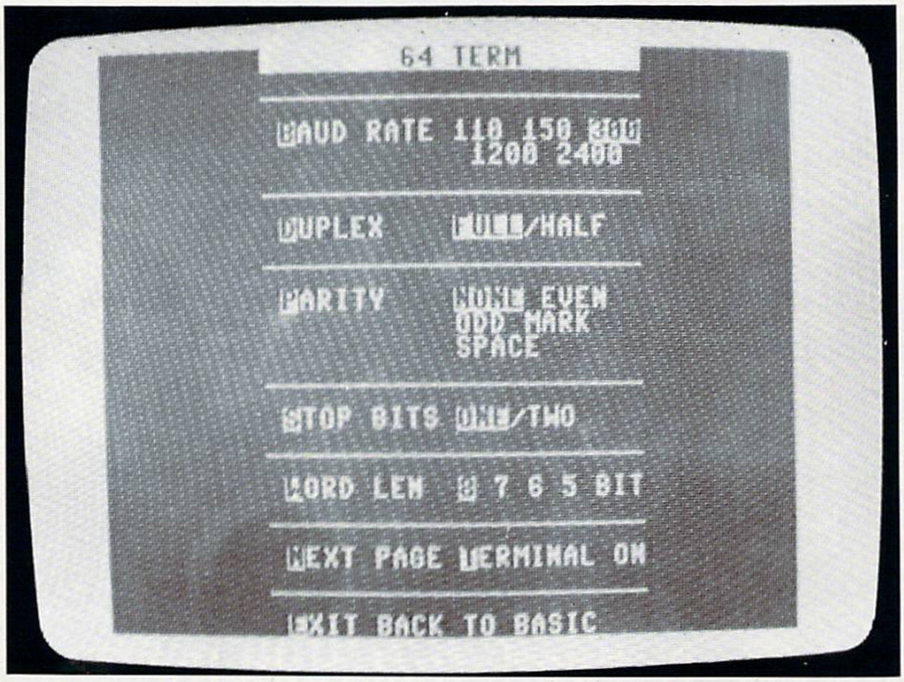
64 TERM
BAUD RATE 110 150 300 1200 2400
DUPLEX FULL/HALF
PARITY NONE EVEN ODD MARK SPACE
STOP BITS ONE/TWO
WORD LEN 8 7 6 5 BIT
NEXT PAGE TERMINAL ON
EXIT BACK TO BASIC

Photo #1: *Menu #1—Communication Format Menu. Use the default values for communication with CompuServe and Dow Jones News Retrieval.*

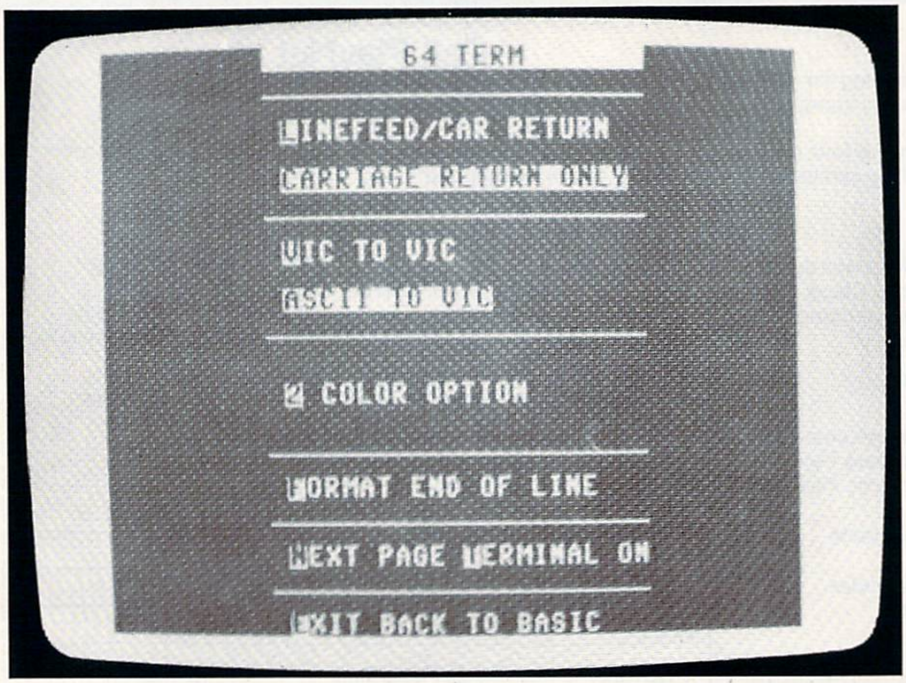
64 TERM
LINEFEED/CAR RETURN
CARRIAGE RETURN ONLY
VIC TO VIC
ASCII TO VIC
C COLOR OPTION
FORMAT END OF LINE
NEXT PAGE TERMINAL ON
EXIT BACK TO BASIC

Photo #2: *Menu #2—VIC Control Menu. Both Menu #1 and Menu #2 are accessible on the terminal software packaged with the VICMODEM and AUTOMODEM.*

did connect, I was disconnected because I was too slow in answering the questions.

You're On!

Here is what you should expect and how you should respond once your phone connection has been made with CompuServe. First, let's discuss the VIC-Modem.

TERMINAL READY. C	Press CTRL-C, CPS or CIS here. C will instantly appear underneath.
USER I.D.:	Enter your I.D. number given in the CPS literature with your VIC-Modem. Don't include the # sign, but do include any commas. Press the return key.
PASSWORD:	Enter your secret password. You won't see it displayed on your screen and the cursor won't move. Don't worry. The computer is taking in the information. Press the return key when done.

Here is the CPS sign-on using the Auto-Modem:

TERMINAL READY.	
DATE	This will not be a current date.
HOST NAME:	Enter CTRL-C, CPS, or CIS. Press the return key.
USER I.D.:	Enter your CPS I.D. number. Don't include the # sign. Press the return key.
PASSWORD:	Enter your secret password. Press the return key.

If you make a mistake on any of these entries, you will get another chance to type it in correctly.

Once you have successfully entered this information, you will have logged on. Beneath the Password prompt will appear:

```
CompuServe Information Service
13:47 EDT Thursday 16-Aug-84 P
```

The time and date will be current and in your time zone. Under this will appear the CPS Main Menu (see Table 1). As you can see, you have seven possible selections just to get you started. You will most often make menu choices to proceed in sequence through the information. You may also type in special commands to access specific information more quickly, and character controls to control the display (see Tables 2A and 2B). You will soon discover that there is a huge amount of information available on many different subjects.

```
CompuServe          Page CIS-1

CompuServe Information Service

1 Home Services
2 Business & Financial
3 Personal Computing
4 Services for Professionals
5 The Electronic Mall (tm)
6 User Information
7 Index

Enter your selection number, or H for more
information.
!
```

Table 1. *CompuServe's main menu. Type GO CBM to get Commodore's Information Network.*

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A problem for a beginner is knowing what to access and how to access it. Take advantage of the free hour you were given by Commodore. You will need it to become familiar with the service. I recommend accessing the Commodore Information Network by typing GO CBM at the Main Menu prompt. You will see a comprehensive menu tailored for Commodore computer users like yourself (see Table 3).

If at any time you want to end your session, type BYE or OFF at a menu prompt. This will immediately log you off the system and display your connect time. This is a handy item for keeping track of phone bills and CPS bills.

You are also given one free hour of use on the Dow Jones News/Retrieval Service. Here is a rundown of its sign-on procedure. (Any differences for VIC-Modem usage are in parentheses.) Once you have input the phone number and been connected, see Table 4 for what will appear.

You must know the commands before going on-line. See Table 5

```
CompuServe          Page CIS-162
BRIEF COMMAND SUMMARY
T—TOP menu page
M—previous MENU
F—FORWARD a page
B—BACK a page
H—HELP
R—RESEND a page
S n—SCROLL from item n
G n—GO directly to page n
N—display NEXT menu item
P—display PREVIOUS menu item
OFF or BYE—logs you off

Press S or RETURN to continue
!
```

Table 2A: *Many of CompuServe's commands are one-letter abbreviations. The Go and Scroll commands require you to include page numbers. Page numbers appear in the top right corner of each menu display. CIS-162 is the page number of this Command Summary menu. To go to the CompuServe main menu, you would type G CIS-1.*

Control Characters: Hold down the control key (CTRL) while simultaneously pressing the character key.

Type	Description
CTRL-C	Interrupts display or program execution so that you can enter another menu selection or command.
CTRL-U	Deletes the line which you are currently typing.
CTRL-V	Redisplays the partial line you are typing and allows you to continue typing the line.
CTRL-H	Backspaces, deleting the character that was there. Note that the character may not disappear from your screen, but it is no longer recognized by the computer.
CTRL-A	Temporarily suspends output at the end of the current line. Enter CTRL-Q to resume.
CTRL-S	Temporarily suspends output immediately, even if it is in the middle of a line. Enter CTRL-Q to resume output.
CTRL-Q	Resumes output after CTRL-A or CTRL-S.
CTRL-O	Stops output which is in process (cannot be resumed).
CTRL-P	Interrupts output and takes you to a command prompt.

Table 2B: *CompuServe's control character commands.*

```
Commodore          Page CBM-1
COMMODORE INFORMATION
NETWORK sm
MAIN MENU

 1  Intro/survival kit menu
 2  New updates to CIN
 3  HOTLINE (Ask Questions) menu
 4  Commodore press releases
 5  Bulletin Boards (SIGs)
 6  Commodore magazine articles
 7  Directory (dealer and user)
 8  Commodore tips
 9  Commodore product line
10  User questionnaire

Last menu page. Select number or press M
for previous menu.
```

Table 3. *Commodore's Information Network main menu.*

TERMINAL READY	
IDENTIFIER (Please type your terminal identifier.) -3003-001	At this prompt, type A and don't hit the return key. This identifies your computer as a Commodore.
Please log in:	At this prompt, type DOW1;; without hitting the return key. The second semicolon will not appear on screen where typed.
Host is now on-line	
WHAT SERVICE PLEASE??????	At this prompt, type DJNS and hit the return key.
Enter Password WWWWWWWWWWWWWWWW MMMMMMMMMMMMMMMM @@@@@@@@@@@@@@@@	At this prompt, type in the combination of letters and numbers given to you in the Dow Jones information. Then press the return key.
DOW JONES NEWS/RETRIEVAL COPYRIGHT (C) 1982 DOW JONES & CO., INC.	
ENTER QUERY	At this prompt, type in a DJNS command.

Table 4. *The sign-on procedure for the Dow Jones News/Retrieval Service.*

TYPE	FOR
//CQ	CURRENT QUOTES
//DJNEWS	DOW JONES NEWS
//HQ	HISTORICAL QUOTES
//UPDATE	ECONOMIC UPDATE
//WSJ	WALL STREET JOURNAL HIGHLIGHTS ON LINE
//DSCLO	DISCLOSURE
//EARN	CORPORATE EARNINGS ESTIMATOR
//FTS	FREE TEXT SEARCH OF DOW JONES NEWS

FOR MORE CHOICES, PRESS RETURN;
FOR HELP, TYPE DATA BASE SYMBOL AND HELP. (EXAMPLE://CQ HELP)

TYPE	FOR
//MEDGEN	MEDIA GENERAL
//MMS	MONEY MARKET SERVICES
//MOVIES	CINEMAN MOVIE REVIEWS
//SPORTS	SPORTS
//WTHR	WEATHER
//WSW	WALL $TREET WEEK

FOR HELP, TYPE DATA BASE SYMBOL AND HELP. (EXAMPLE://WSW HELP)

Table 5: *After entering your Dow Jones password, you will be prompted by ENTER QUERY. To access the master menu, type //MENU and press the return key.*

for the Dow Jones Master Menu and commands to access its major databases. Notice the two slashes before each command. You must type these in. Typing //MENU will give you the master menu. In order to exit Dow Jones, type DISC (no slashes) at any prompt, then press the return key. This will display the time on and the time off, the date and the message "Dropped by Host System."

A smart way to begin your telecommunications sojourn is to call the toll-free 800 number of the particular service that you intend to log onto *before* you go onto your computer. I called up DJNS, 1-800-257-5114, to find out the log-on procedure and some of the commonly used commands. If I hadn't done this before actually trying to go on-line, it would have been disastrous. This is because DJNS is controlled more by commands than by menu choices. When you sign up for DJNS, you will receive in-depth information about all the databases offered. The CompuServe toll-free number is 1-800-848-8199.

At Your Fingertips

There are many aspects of telecommunications for you to discover. Don't be intimidated by this new form of communication. It actually is a bit more convenient than some traditional ways. You have a great deal of flexibility. You can access encyclopedias, sports information, weather and special groups of computer users, and you can talk one-to-one with a friend. Telecommunications is a blend of the ham radio, CB radio, library, telephone and postal service. It combines nearly all the forms of communication with which we are traditionally familiar.

Recommended reading:
The Computer Phone Book Online Guide for the Commodore Computers, by Mike Cane;
The Commodore 64 Survival Manual, by Winn L. Rasch;
The Dow Jones News/Retrieval Fact Finder, from the publishers of the *Wall Street Journal*. R

Address all author correspondence to Margaret Morabito, c/o RUN *editorial, 80 Pine St., Peterborough, NH 03458.*

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The First Step

By GUY WRIGHT

If you want to communicate with your computer, you'll have to learn to speak its language. This article explains some Basic concepts and phrases that will set you on your way to programming.

Trying to learn Basic is like trying to learn a foreign language. You have to memorize some of the words and learn how they are put together in meaningful sentences.

Fortunately, there are only about 63 words of Basic and only a handful of "grammatical rules" that you have to learn. The hardest part is learning programming logic and how to troubleshoot (or debug) a program.

Servants and Toaster Ovens

Computers are about as smart as toaster ovens. You have to tell the computer exactly what to do through a program, which is a step-by-step set of instructions written in English/computerese and called Basic. Each instruction must be simple enough for the computer to understand, and sometimes that is not easy to achieve.

Imagine that a very fast, but very stupid, servant is going to show up at your house to do anything you wish. The trouble is that you won't be there to meet him,so you must leave all your instructions on numbered cards.

Each card can have only one instruction on it, and the servant must follow the cards in the order that they are given. If you want him to sweep the hallway, you must first give instructions to get a broom from the closet, or he will get confused when it comes to the "sweep" instruction.

You can see how difficult things would be if you wanted the servant to balance your checkbook or keep track of your business finances.

One pitfall that new programmers run into is trying to tackle a problem that is too complicated. You must learn a few difficult concepts when starting out. One reason these concepts are sometimes hard to understand is that books on programming are usually not written in the kind of English that most of us are used to speaking. This article uses some terms that may sound a bit silly, but may also be clearer and easier to understand.

Variables

Think of variables as pockets on a carpenter's overalls. Each pocket bears a label that is either a letter and a number or two letters (for example, LH for left hip pocket or H1 and H2 for hip pocket 1 and hip pocket 2). Furthermore, each pocket can hold only one thing at a time, and some pockets can hold only certain types of things.

There are a number of different kinds of computer pockets, but we only have to worry about two right now: pockets that will hold only numbers and those that will hold anything you can type on the keyboard (letters, numbers, cursor keys, and so on.).

In computer jargon, these two kinds of pockets are called numeric variables and string variables. A simple way of telling them apart is that string variables have dollar signs at the end of the label. AA is the label for a number pocket, and AA$ is the label of a string pocket which can hold anything. It would probably be easier if there were only one kind of pocket, but computers need to be told when to add two numbers or when to add two words.

You might think of the $ pocket as holding words (or strings). Sometimes the words make sense ("cat," "dog," "one"); sometimes they don't (CO87JN).

If you tell the computer to add the words "CAT" and "DOG," it will give you "CATDOG." Tell it to add the numbers 1 and 2 and it will give you 3. But tell it to add the "words" "2" and "4" and it will give you 24. (Remember, a word can be any character or combination of characters typed on the keyboard.)

You must also learn how the computer moves information in and out of pockets, and how it performs arithmetic operations on things that are already in pockets. An equals sign (=) means "put into this pocket anything on the right of the =." So, if you want the computer to put a 6 in the LH pocket, you would type LH=6. If you want to put the word CAT into the CA$ pocket, you would type CA$="CAT". The quotes are essential for string variables.

If you want the computer to put the result of adding two numbers into a certain pocket, you might type RE = 7 + 4. The computer would add the numbers first and then put the answer into the pocket with label RE.

If you want the computer to take a number from one pocket, add it to the number in another pocket and then put the answer into a third pocket, you could type TH = FI + SE. In this case, the computer would get the number out of pocket FI (for first), add it to the number from pocket SE (for second), and put the answer into pocket TH (for third). Remember that everything on the right of the equals sign is done first, and then the answer is put into the pocket indicated on the left of the equals sign.

With that in mind, it makes sense to type AN = AN + 6, for example. If the line were AN = 4 + 6, the computer would first add 4 and 6 and then store the answer in pocket AN. If the line were AN = FI + 6, the computer would first get the number stored in FI, add it to 6, then store the answer in AN. So, if you type AN = AN + 6 and press the return key, the computer first gets the number already in AN, adds it to 6 and then puts the new answer back into AN.

The whole idea of variables is worth playing with until you understand it. Try a few experiments on your computer and see what happens. There is nothing you can type on the keyboard that can harm the computer!

Computer Operations

All computer action can be broken down into three types: getting information (input), doing something with information (processing), then putting that information somewhere (output).

Input

Input is the process of getting information into the computer so something can be done with it. One important block of information that must be fed into the computer is the program itself (otherwise, the computer won't know what to do when it gets the rest of the information).

The first step is typing the program. You can either run the program after typing or save the program to be loaded back into the computer later. In any case, the program must somehow get into the computer.

The easiest way is to buy the program from someone else and then load it in with a Datassette or disk drive. But if you want to write your own programs, you must have some way to save them. Otherwise, each time you want to use the program, you will have to type the entire thing all over again. This may be fine if it is a very short program or is something that you will use only once. However, it is usually better to write a program, save it on tape or disk, and then run it, debug it, change it or whatever, knowing that if anything is destroyed, you have a backup copy.

All computer action can be broken down into three types: getting information (input), doing something with information (processing), then putting that information somewhere (output).

A note: When you save a program to tape or disk, everything in the pockets is thrown away, so if you want the program to retain certain things in certain pockets, you will initially have to write them into the program. For example, if you want the words "Hello, Sam" to show up when the program is run, you will have to put those words somewhere in the program.

As soon as a program is in the computer, there is other information that will be added as the program runs. (Even if you are the only one who will ever use the program, there are going to be times when you will want to input new information.)

If you want to design a program that adds user-supplied numbers, you must get those numbers into the program while it is running. Any information that is entered into the computer while the program is running is input (for example, entering your name, entering numbers or even moving a joystick). The most frequently used command for getting information into the computer while a program is running is Input.

When the computer sees the word Input, it stops the program and waits for information to be typed and the return key to be pressed. It then puts what was entered into the specified pocket and continues on with the program.

This means that the variable you specify in the Input command must be either a number pocket (if you expect to input a number) or a string pocket (if you expect to input anything else). If the typed response doesn't match the pocket, you will get an error message.

Processing

The next activity that a computer performs is called processing. This is the operation that the computer performs with information that is input in any of the ways described above.

Many areas of processing have their own names and fall into a few categories.

Loops, or repeating actions, tell the computer to do something over and over a specified number of times.

Arithmetic operations are the adding, subtracting, multiplying, and so on, that computers do with blinding speed and accuracy.

Subroutines are mini-programs within a program that can be used over and over.

Decision making (in a very crude fashion) is performed by most programs at one time or another, even if it involves nothing more than deciding when to end.

Storage and recall simply involves shuffling information from one place to another.

Loops

There are two basic ways to get the computer to do something

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over and over. To return to our earlier analogy, the simplest way is to tell it to go back to a certain line or "card" number and begin following instructions from there. The servant reads through card numbers 1, 2, 3, 4 and 5, then card 6 says something like "go back to card number 2 and start over from there." This leads to a problem, however.

Being the literal-minded beast that it is, the computer will perform the tasks on each of the cards (if they are in the right form), get to card 6, start over from 2, up to 6 again, back to 2, then up to 6, then back to 2, and so on, *ad infinitum*. It will keep doing the same things over and over until you pull the plug or press the stop key.

This is called an endless loop, for obvious resons. There are ways around it.

If step 3 says "add 1 to the number in pocket LH," and then step 4 says "if the number in pocket LH equals 47, then end," the computer would repeat steps 2 through 6 47 times. Each time through the loop, it would add 1 to LH, and when LH=47, the program would end.

(There is still a potential problem here. If the number in pocket LH happened to be 50, then LH would just keep getting larger and larger but would never equal 47. So the computer would still be caught in an endless loop.)

The idea of putting a test inside a loop is called a flag. There is a certain type of loop, called a For. . .Next loop, complete with a built-in flag, already in Basic. You tell the computer how many times you want it to repeat the operation, and when it reaches that number, it goes on to the next instruction in the program.

The format for a For. . .Next loop looks like this:

```
FOR pocket = starting number TO ending
number
```

and then later in the program:

```
NEXT pocket
```

In our example, card number 2 would read FOR LH = 1 TO 47, and card number 6 would read NEXT LH. Each time the computer reached card number 6, it would jump back to card number 2 until LH equaled 47. When that happened, the computer would jump ahead to card number 7.

If you want the computer to print the word Hello 12 times and then stop, the program might look like this:

```
10 FOR RH = 1 TO 12
20 PRINT"HELLO"
30 NEXT RH
40 END
```

RH is the flag pocket that will keep track of how many times the computer has gone through the loop. We also usually number the cards (program lines) by tens (the computer doesn't care what the numbers are; it always goes from the lowest to the highest number, unless we tell it otherwise). Also, numbering by tens leaves room to insert program lines later on.

Being the literal-minded beast that it is, the computer must be told exactly what to do through a step-by-step set of easy-to-understand instructions.

In the example program above, line number 10 sets up the loop. Here we tell the computer the variable to use as a flag (RH), what number we want it to start counting from (1), and how high to count (12) before ending the loop and going on with the program.

Line 20 prints our message to the screen (output).

Line 30 tells the computer to go back to the set-up line (line 10) and start over again.

Line 40 tells the computer to stop the program. This is where the computer will go when it has repeated the loop 12 times, because it always goes to the line following the line with NEXT in it when it finishes a FOR. . .NEXT loop.

Arithmetic Operations

Arithmetic operations are the kinds of actions that computers do best. They add, subtract and mul-

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```
PRINT 44459.2576/456.32
```

and before you can take a deep breath, it will print 97.43.

If you want a program that just does a lot of fancy, fast number manipulation, then you came to the right place. The trick is phrasing the formulae so that the computer can perform the right things in the right order. If you have a long, complex formula that you want the computer to calculate, there are simple rules you can follow. Either break up the formula into small steps, with each step on a separate line, or put the things you want done first inside parentheses; i.e., enter PRINT 12*(5+32)-(43.65+78) or use this program:

```
10 X = 5 + 32
20 Y = X * 12
30 Z = 43.65 + 78
40 LH = Y - Z
50 PRINT LH
```

The latter is easier to understand and less likely to confuse the computer. (It is also a good example of shuffling around information in the various pockets.)

Subroutines

Subroutines are mini-programs that are used to perform a series of instructions many times within a given program. An example is a routine that prints a menu of options on the screen. Once you select an option, the computer goes off to perform it, then returns to print the menu again.

To send the computer to the subroutine, you type GOSUB and the line number where the routine begins. The computer jumps to that line, performs the tasks specified, and then, when it sees the Basic word RETURN after the last step, it jumps back to the program line immediately after the GOSUB. A simple menu subroutine might look like this:

```
10 GOSUB 100
20 IF LH=1 THEN PRINT"THIS"
30 IF LH=2 THEN PRINT"THAT"
40 IF LH=3 THEN PRINT"SOMETHING
   ELSE"
50 GOTO 10
100 PRINT"SELECT A NUMBER"
110 PRINT"BETWEEN 1 and 3"
120 PRINT
130 PRINT"1 - PRINT THIS."
140 PRINT"2 - PRINT THAT."
150 PRINT"3 - PRINT SOMETHING ELSE."
160 INPUT LH
170 RETURN
```

The above program starts by shooting off to the subroutine starting at line 100. Lines 100–150 print the menu on the screen (line 120 just prints a blank line to make the screen look neater). Line 160 tells the computer to wait until the user types something and presses the return key. As soon as the return key is pressed, the number typed gets put into pocket LH. Line 170 sends the computer back to line 10. Next, in lines 20–40, the computer tests the number in LH against 1, 2 and 3. If LH matches one of these numbers, then the appropriate message is printed on the screen, and line 50 sends the computer back to start the whole procedure again—an endless loop.

It is essential that the computer not encounter the word RETURN in a program unless it already has been sent to a subroutine with the word GOSUB. If you removed line 50 and let the program run, it would go to the subroutine (lines 100–170), print the menu, get a choice, return to the print section (lines 20–40), drop down to print the menu again, wait for another choice and then, when it arrived at the RETURN, it wouldn't know where to return to and would spit out a Return Without GOSUB error message.

Most programmers put all their subroutines into one portion of their programs and direct the computer around that area with the GOTO statements. (GOTO simply tells the computer to jump ahead or backward to a line number not in the usual sequence and continue the program from there.)

Decision Making

Decision making, for a computer, basically involves comparing things; then, depending on the results, going to another part of the program. In the last example, I used the most common form of decision making—the If. . .Then statement. This means "If the following comparison is true, then do whatever comes after the THEN word; if the comparison is not true, then go to the next line in the program." A comparison can be either =, <, >, <>, => or =< (equals, less than, greater than, not equal to, equal to or

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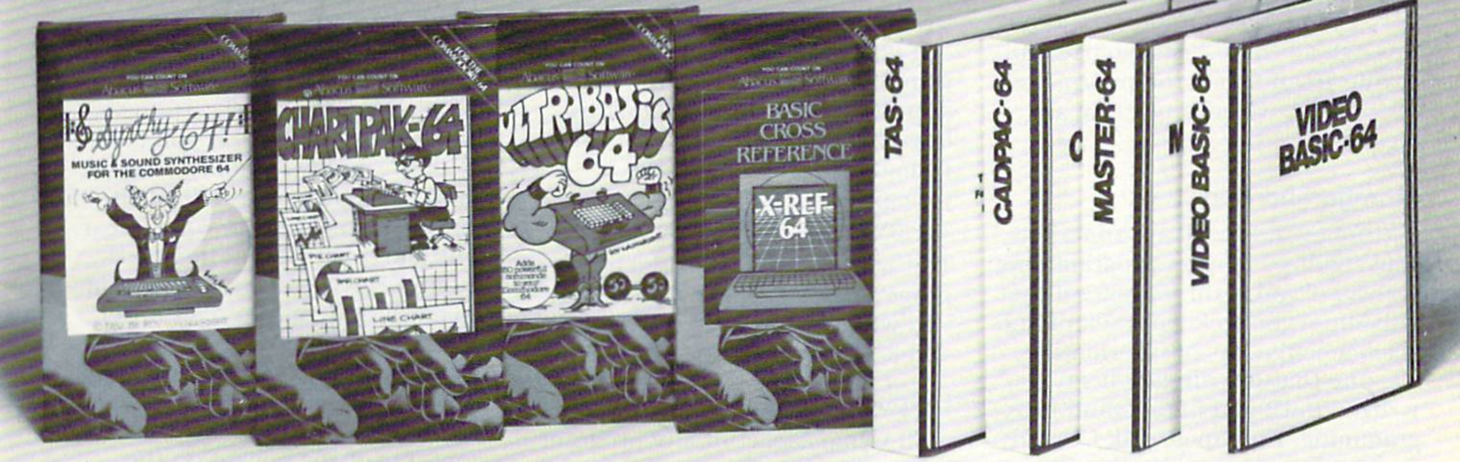

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greater than, equal to or less than, respectively).

So, in the example, line number 20 checks to see if LH is equal to 1. If it is, then the computer prints the word THIS. If LH does not equal 1, then the computer automatically drops down to the next line (line 30), where another test is performed. If, at the menu, the user had entered 5 instead of 1, 2 or 3, then the computer would fall through all three tests, go back up to line 10 and start the program all over again, without printing any message.

Storage and Recall

Storage and recall are functions that require complex programming ability. If you want a program that will allow you to keep track of and easily change lots of information, use one that has already been written until you understand programming, file tapes, disk I/O and so on. You can then either write your own program or modify another one.

You can write programs that contain lots of information, but it can be difficult to change that information. If you simply want the computer to keep track of a list, then type the information with line numbers in front of each item. That way, when you want to go over that list, load the program and, instead of typing RUN, type LIST to see the program. If you want to change that information, then load the program, change the lines that need changing and resave it.

If you want your computer to print out individual lines without a search routine, you can do it by beginning each line with a Print command. For example:

```
10 PRINT"AUNT SARA 123-456-7890"
20 PRINT"UNCLE JESSIE 890-567-1234"
```

This is probably one of the crudest programs for keeping a phone list you will ever see, but it will work, and it's easy to write.

Output

The final aspect of any program is getting the information out of the computer in the form of output to the screen or printer. You can tell the computer to add two numbers (A = 2 + 3), and it will do it lightning-fast and come back with READY and the flashing cursor that signals it has finished the addition. If, however, you don't tell it to print the answer (PRINT A), you will never see the result.

The Print command is probably the most often-used command in Basic; without it, we have no way of knowing what's going on inside the computer.

A Print statement may take various forms. PRINT"xxx" will print on the screen whatever you put inside the quotation marks (even cursor movements or certain symbols like SHFT CLR). If you type PRINT", and then hold down the shift key and press the CLR/HOME key, a reversed heart will appear. Add the closing quotation mark, then press the return key. If you do everything in the right order, the screen should clear.

Another form of the Print command is PRINT xx, where xx is a variable name. This will print the contents of the pocket on the screen. You can also use the computer as a calculator. For instance, PRINT 3 + 4 will print 7 on the screen.

Hang In There

Every programming problem can be broken down into pieces, and those pieces can be broken down into smaller pieces, until you can match the commands you do know with the pieces. As the parts get smaller and smaller, you will find that more and more of them have Basic words to do just that one thing.

Learning to program is an incredibly frustrating experience for everyone. That you will initially encounter more error messages than answers does not mean that you are stupid. There isn't a programmer alive who didn't have to wade through the same swamp.

Keep reading and rereading the manuals, take a command at a time and try to figure out how it works, look at other people's programs, play around with programs out of magazines and ask friends for help. If all else fails, there are thousands of programs to buy or type out of magazines. Most of all, enjoy the challenge. R

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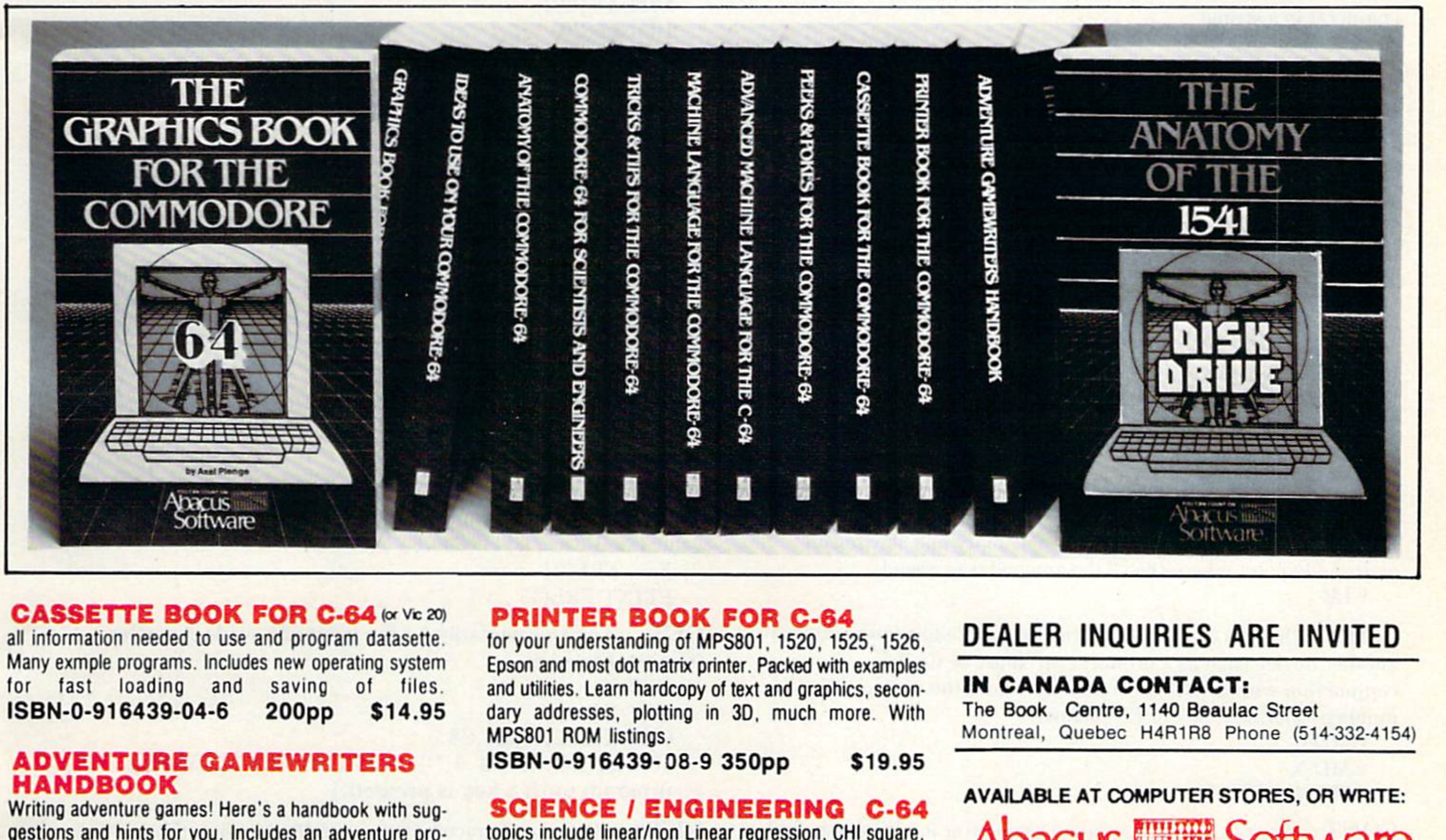
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Keywords & Abbreviations Used in Basic Programming

ABS Returns the absolute value of a number or variable.

```
A = ABS(A)
```

AND Boolean logic test. Also used to test whether one or more statements in an IF...THEN statement are true.

```
X = PEEK(Z) AND 15
IF A = 2 AND B = 4 THEN END
```

ASC Returns the Commodore ASCII value of the first character in a string.

```
X = ASC("RUN")
X = ASC(Z$)
```

ATN Returns the arctangent of a number or variable that is expressed in radians.

```
X = ATN(2)
X = ATN(Z)
```

CHR$ Converts a Commodore ASCII code number to its equivalent character. The complement of the ASC statement above.

```
X$ = CHR$(14)
PRINT CHR$(14)
```

CLOSE Used to end communications with any device that has been OPENed. See OPEN, below.

```
CLOSE 4
CLOSE X
```

CLR Resets all variables, arrays, loop counters, etc., without destroying the program in memory. Has the same effect as LOADing the same program back into memory and starting all over at the point where the CLR command was issued.

```
CLR
```

CMD Changes the output (normally directed to the screen) to another device such as a printer. CMD must be used in conjunction with the OPEN command where the device 'file' number is defined. See OPEN, below.

```
CMD4
CMD X
CMD 4, "RUN"
```

CONT Starts a program running again after it has been halted by pressing the RUN/STOP key or encountering a STOP or END statement. You may LIST, PRINT, or change variable values before using CONT, but you may not edit lines or cause any errors. If the program halted because of an error, you will get a CAN'T CONTINUE error message.

```
CONT
```

COS Returns the cosine of a number or variable that is expressed in radians.

```
X = COS (3.4)
X = COS (Z)
```

DATA Tells the computer that the numbers and or strings that follow on that line are pieces of information to be used elsewhere in the program and not commands to be acted upon. The information can only be accessed with a READ statement and must be separated by commas.

```
DATA 1,2,3,4
DATA ABC,DEF,GHI,JKL
DATA "RUN",4,5,6,"MAGAZINE",7,8,9
```

DEF Used to define a numeric function or operation to be used later in a program.

```
DEF FN AD (X) = X + 3
DEF FN SB (Z) = Z - 5
```

DIM Used to define an array (matrix) to be used later in the program. Arrays may contain integers, strings, or floating point numbers.

```
DIM X%(20)
DIM X$(20)
DIM X(20)
DIM X(20,2)
```

END Used to halt the execution of a program.

```
END
```

EXP Raises the mathematical constant e (2.71828183) to the indicated power.

```
X = EXP(Y + 2)
```

FN Passes values to a previously defined function (see DEF, above).

```
10 X = FN SB (22)
20 PRINT FN AD (Y)
```

FOR Begins a 'loop' that repeats a set number of times. Used in conjunction with TO, STEP and NEXT (see below.)

```
FOR X = 1 TO 10
FOR X = Y TO Z
```

FRE Displays current amount of usable memory. (Note: if value is negative, add 65536.)

```
X = FRE(0)
PRINT FRE(1)
```

GET Waits momentarily for the input of a single character from the keyboard.

```
GET X
GET X$
GET X,Y,Z,A$,B$,C$
10 GET X$ : IF X$ = "" THEN GOTO 10 {Will halt
program until a key is pressed.}
```

GET# Inputs a character from a specified device. (The device must first be 'opened' with the OPEN command. See below.)

```
GET#3,A
GET#1,X$
```

GOSUB Sends the computer to a subroutine elsewhere in the program. When the subroutine has finished executing and the RETURN statement is encountered, the program will jump back and resume execution immediately after the GOSUB statement.

```
GOSUB 20
IF X = 1 THEN GOSUB 100
```

GOTO Sends the computer to a specified line number to pick up execution of the program from there.

```
GOTO 100
IF X = 3 THEN GOTO 20
```

IF...THEN Decision-making function that tests or compares values. If the test result is 'true,' then the commands that follow the word THEN are executed; otherwise, the computer goes on to the next line in the program. IF test-statement-is-true THEN do-this. More than one test may be included in an IF...THEN

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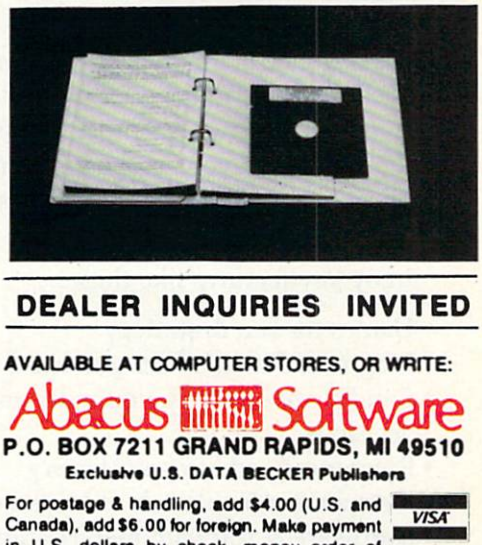

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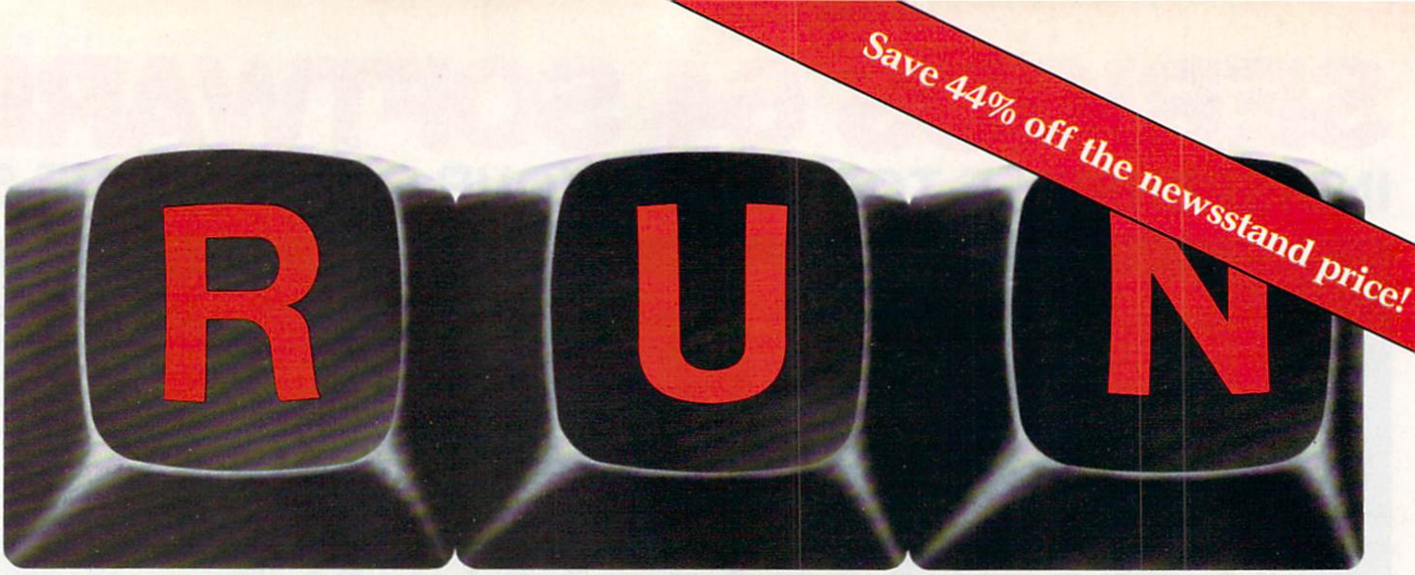
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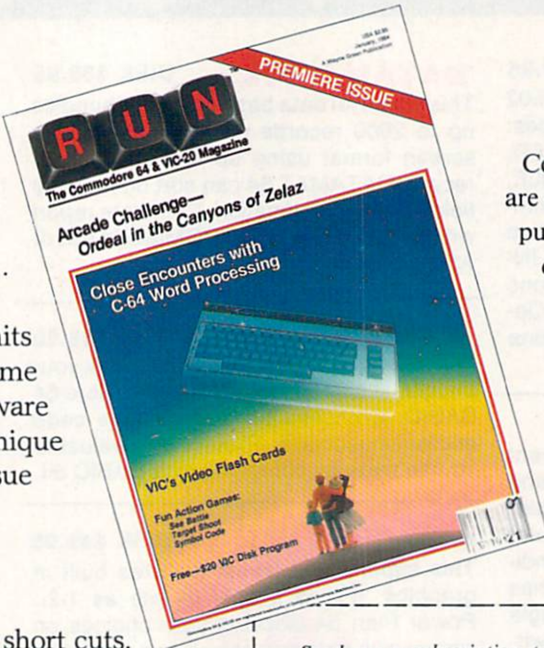
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statement if each test is separated by AND, OR or NOT.

```
IF X = 2 THEN END
IF D$ = ''YES'' THEN GOTO 20
IF X = 1 AND Y = 2 THEN PRINT ''HELLO''
IF X = < > 1 THEN GOSUB 60
IF X>1 OR Y<1 THEN RUN
```

INPUT Halts execution of a program; waits for something to be typed on the keyboard and the Return key to be pressed before continuing operations. The variable specified (string or numeric) must match the type of information that is entered by the user, or you will get a REDO FROM START message. More than one piece of information can be entered in one INPUT statement if the variables to be used are separated by commas. A message or prompt can be added to the INPUT statement if it's enclosed in quotation marks and followed by a semicolon.

```
INPUT X
INPUT B$
INPUT A,B,C
INPUT ''ENTER YOUR AGE'';X
INPUT ''TYPE YOUR NAME'';N$
```

INPUT# Used to get information from a device (other than the keyboard) that has been previously OPENed (see OPEN, below). The information cannot be longer than 80 characters in length or a ?STRING TOO LONG error will occur.

```
INPUT#1,A
INPUT#3,B$
```

INT Returns the integer (whole number value) of a number or variable.

```
X = INT(3.56)
PRINT INT ( – 5.765)
```

LEFT$ Returns a specified number of characters from a string, beginning with the first character (from left to right).

```
A$ = LEFT$(''SALLY'',3) {A$ would then equal ''SAL''}
X$ = LEFT$(B$,7) {X$ would then equal the first seven
characters in B$}
```

LEN Returns the number of characters in a string.

```
PRINT LEN(X$)
X = LEN (''HELLO'')
```

LET Assigns a value to a variable. (Optional and therefore rarely used.)

```
LET X = 12
LET X = ''HELLO''
```

LIST Displays part or all of a program (or directory) on the screen. A range may be specified so that the program may be displayed in sections. Note: you may slow a listing by holding down the CTRL key.

```
LIST {lists entire program.}
LIST–50 {lists everything from the first line of a
program through line 50.}
LIST 50–{lists everything from line 50 through the last
program line.}
LIST 50–100 {lists all program lines from line 50
through line 100.}
```

LOAD Reads a program from tape or disk into the computer's memory.

```
LOAD {loads the next program from tape, regardless of
title.}
LOAD''DEMO'' {loads from tape the program titled
'demo'.}
LOAD''DEMO'',8 {loads from disk the program titled
'demo'.}
LOAD''DEMO'',1,1 {loads from tape a machine
language program titled 'demo'.}
LOAD''DEMO'',8,1 {loads from disk a machine
language program titled 'demo'.}
```

LOG Returns the natural logarithm (to the base of e) of a number or variable.

```
X = LOG(2.5)
PRINT LOG(Y)
```

**MID$** Returns a specified number of characters from within a string, beginning at a specified character. The format is MID$(string,starting point,number of characters).

```
X$ = MID$(''MAGAZINE'',3,4) {makes X$ equal to
'GAZI'.}
PRINT MID$(A$,3,4) {prints four characters within A$,
beginning with the third character in the string.}
X$ = MID$(A$,B,C) {makes X$ equal to C number of
characters from A$, beginning with the Bth character
in the string.}
```

NEW Erases a program from memory.

```
NEW
```

NEXT Used in a FOR...TO...NEXT 'loop' (see FOR, above.) When the computer encounters the word NEXT in a program (assuming that a FOR...TO statement has been read earlier in the program), it first increments the counter (either by one or by the increment specified with the STEP instruction), then jumps back to the program line containing the FOR statement, where it tests the counter against the ending loop value. If the loop has repeated the specified number of times, then the program 'falls through' to the instruction immediately following the NEXT command. The NEXT should be followed by the counter name.

```
NEXT X
NEXT Z
```

NOT Returns the two's-complement of a value (value plus one times minus one). May also be used in IF...THEN comparison tests to reverse the true/false result of a comparison.

```
X = NOT 54 {X would equal – 55}
IF NOT(A = B)THEN PRINT ''NOT EQUAL''
```

ON Used in conjunction with GOTO or GOSUB to send the computer to one of a selection of line numbers, depending on the value of a variable. The format is:
ON variable GOTO line1 , line2 , line3 , line4...etc. (where 'variable' is numeric and the line numbers are separated by commas).

```
ON X GOTO 50 , 60, 70 , 80 {if X = 1, the program is
sent to line 50; if X = 2, the program is sent to line 60,
etc. Note: if X is less than 1 or greater than the number
of line numbers specified in the list, then the program
'falls through' to the command immediately following
the ON...GOTO statement.}
ON Y GOSUB 100 , 200 , 300 {If Y = 1, the computer
behaves as if the line read GOSUB 100, returning to the
command that follows the ON...GOSUB statement.}
```

OPEN Used to prepare the computer for input or output to a specified peripheral device, using a specified file number and device number. Open commands may also include information on file types, modes, addresses, etc.

```
OPEN 4,4 {opens file number 4 to printer.}
OPEN 15,8,15 {opens file number 15 (with secondary
address 15) to disk drive (device 8). This is the disk
drive command channel. See peripheral device manuals
for specific information.}
```

OR Used in IF...THEN comparisons to combine conditions to be met. Also a Boolean 'OR' command, used to set individual bits of a byte.

```
IF X = 1 OR X = 2 THEN PRINT ''ONE OR TWO''
IF A = 2 OR B = 2 OR C = 2 THEN PRINT ''ONE OF
THESE EQUALS TWO''
X = 16 OR 4  {X would equal 20}
X = 16 OR 18 {X would equal 18}
```

PEEK Reads the value in a specified memory location (0–65535) and returns an integer in the range 0–255.

```
X = PEEK(1234) {X would equal the value stored in
memory address 1234.}
PRINT PEEK(X) {Prints the value stored in memory
location X.}
```

POKE Places a value (in the range 0–255) into a specified memory location (0–65535).

```
POKE 1234,10 {Places the value 10 into memory
location 1234.}
POKE X,Y {Places the value Y into memory location X.}
```

POS Returns the current cursor position in the range 0–79. A 'dummy' argument must be stated, although the value is not critical.

```
X = POS(0) {Note: the zero is the 'dummy' argument,
and is ignored by the computer.}
PRINT POS(1)
```

PRINT Outputs a string, number, control code, calculation, etc., to the screen, printer, disk or other output device. Normally, output is directed to the screen unless specified earlier with CMD (See CMD, above.)

Statement	Result
PRINT 5	5
PRINT A	{value of A}
PRINT 5 + 3	8
PRINT A$	{value of A$}
PRINT “RUN”	RUN
PRINT “{SHFT CLR}”	{clears the screen.}
PRINT CHR$(34)	{clears the screen.}
OPEN4,4:CMD4:PRINT“HI”	{prints the word HI on printer}
PRINT	{carriage-return and line feed.}

NOTE: there are many more variations to the PRINT statement. See your manual for more information.

PRINT# Same as PRINT (see above), except the output is sent to a logical file (usually a peripheral device such as a disk drive or printer) specified in the OPEN statement (see above). NOTE: Do not use a question mark as an abbreviation for PRINT#, as it will result in a Syntax error.

```
PRINT#4,“RUN” {Outputs the word RUN to file
number 4.}
OPEN15,8,15:PRINT#15,“I” {Sends the Initialize
command to the disk drive over file number 15 (the
command channel).}
```

READ Returns the next element of a DATA statement list (see DATA, above) and places it in a specified variable.

```
READ A
READ A$
READ A,B,C
```

REM Short for remark. Used to put comments that will not be executed into a program. Everything on a line following a REM statement is ignored by the computer during execution of the program, but can be displayed using LIST (see above).

```
REM THIS IS A COMMENT THAT WILL NOT BE
PRINTED
10 PRINT CHR$(34) : REM CHR$(34) EQUALS A QUOTE
```

RESTORE Resets the internal data pointer so that the next READ statement will begin with the first data element in the first DATA statement.

```
RESTORE
```

RETURN Signals the end of a subroutine. When the computer encounters a RETURN (after being sent to a subroutine with GOSUB), it jumps back to the statement immediately following the GOSUB statement.

```
RETURN
```

RIGHT$ Returns a specified number of characters from a string counting from the last character (right to left).

```
X$ = RIGHT$(“MAGAZINE”,3) {X$ would equal INE.}
PRINT RIGHT$(X$,3) {would print the last three
characters of X$.}
```

RND Generates a random number in the range of 0.0 to 1.0. The RND function requires an 'argument' value.

```
X = RND(0) {The 0 will generate a number based on
the system clock. X will be between 0 and 1.}
X = INT(RND(–1)*10)+1 {Generates a number
between 1 and 10. The –1 will 're-seed' the
generator.}
```

RUN Used to begin the execution of a program. A line number may be specified to designate which line to begin execution with.

```
RUN
RUN 50
```

SAVE Stores a basic program in memory to a specified storage device such as a Datassette or disk. A program name should be specified.

```
SAVE“PROGRAM” {saves to tape with name
'program'.}
SAVE“PROGRAM”,8 {saves to disk with name
'program'.}
X$ = “DEMO” : SAVE X$ {saves program to tape with
name 'demo'.}
```

NOTE: For machine language saves, check manuals for other SAVE options.

SGN Returns a value 1, 0, or –1, depending on the sign of a number or expression. If the number or expression is positive, the returned value is 1; if it is zero, the returned value is 0; if negative, the returned value is –1.

```
X = SGN(Y)
```

SIN Returns the sine of a number or variable that is expressed in radians.

```
X = SIN (Y)
PRINT SIN (4.5)
```

SPC Used to force extra spaces between material to be printed. The designated number of spaces is inserted between the last item printed and the next item to be printed.

```
PRINT SPC(5) “RUN” SPC(5) “IS” SPC(5) “FUN”
{would print     RUN     IS     FUN}
```

SQR Returns the square root of a number or variable.

```
X = SQR(9) {X would equal 3}
```

STATUS Returns a value related to the last input/output operation. (Check manual for a more detailed description of value meanings.)

```
IF STATUS = 64 THEN PRINT “END OF FILE”
```

STEP Used to vary the counting increment in a FOR...NEXT loop. (See FOR, above.) STEP is optional (if omitted, a value of 1 is used). When NEXT is encountered, the counter value is incremented by the STEP value (positive or negative), and the loop continues.

```
FOR X = 1 TO 20 STEP 2
FOR T = 100 TO 10 STEP –10
```

STOP Used to halt the execution of a program. (Has the same effect as pressing the RUN/STOP key.) All variables are unchanged, and the program may be continued using the CONT command (see above).

```
STOP
```

STR$ Converts a numeric value into a string value.

```
X$ = STR$(1234)
X$ = STR$(Y)
```

SYS Transfers control of the computer to a machine language program in memory (similar to a GOSUB to a machine language subroutine). The address of the routine must be specified in the range 0–65535.

```
SYS1234
```

TAB Used with PRINT (see above). TAB positions the cursor on the current screen line to a specified location relative to the first space on a line. Unlike SPC (see above), which moves the cursor forward from the last printed item, the TAB can move the cursor forward to a specified column regardless of what has already been printed on that line.

```
PRINT TAB(2)"RUN" TAB(9)"RUN"
{result:    RUN    RUN}
PRINT TAB(2)"RUNRUN" TAB(9)"RUN"
{result:    RUNRUN    RUN}
```

TAN Returns the tangent of a value that is expressed in radians.

```
X = TAN(.48)
X = TAN(Y)
```

THEN Precedes the action to be taken if the comparison result of an IF. . .THEN statement is 'true'.

```
IF X = 2 THEN PRINT "EQUALS TWO"
IF A = B THEN GOTO 100
IF A = B THEN END
```

TIME or TI A variable that holds the value of the interval timer (activated when the computer is first turned on). The interval timer counts in 1/60th second increments and can be read like any variable.

```
PRINT TIME
PRINT TI
PRINT TI/60 {number of seconds since power up.}
```

**TIME$** A string variable that acts like a digital clock, returning hours, minutes and seconds in the form HHMMSS. The TIME$ value may be read like any variable, but it may also be set to a desired starting value.

```
PRINT TIME$
TIME$ = "052022"
```

TO Precedes the value in a FOR. . .NEXT loop that signals when the loop should end.

```
FOR X = 1 TO 10
FOR A = 100 TO 0 STEP -5
```

USR Used to access a machine language subroutine whose starting address is pointed to by the values previously stored in locations 785 and 786. Values are passed to and from the subroutine starting at location 97 (floating-point accumulator). See manuals for more detailed information.

```
X = USR (5.76)
Y = USR (X)
```

VAL Returns the numeric value of a string variable (complement of the STR$ function above). Returns a 0 if the first character of the string variable is anything other than a plus sign, minus sign, decimal point, or numeric digit.

```
X = VAL ("55.7") {X would equal 55.7.}
Y = "1234" : X = VAL(Y) {X would equal 1234.}
```

VERIFY Used to ensure that a program has been saved (or loaded) properly. Verify compares the program in memory with the program on tape or disk and returns a ?VERIFY error if the two do not match exactly.

```
VERIFY {Compares memory to the next program
encountered on tape.}
VERIFY "RUN" {Compares memory to next program
encountered on tape with the title 'run'.}
VERIFY "RUN",8 {Compares memory to program on
disk with title 'run'.}
```

WAIT Suspends execution of a program until a specified memory location contains a specified value. See manuals for more detailed information.

```
WAIT 197,63 {wait until any key is pressed.}
```

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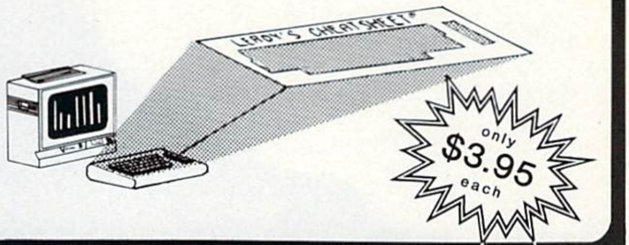

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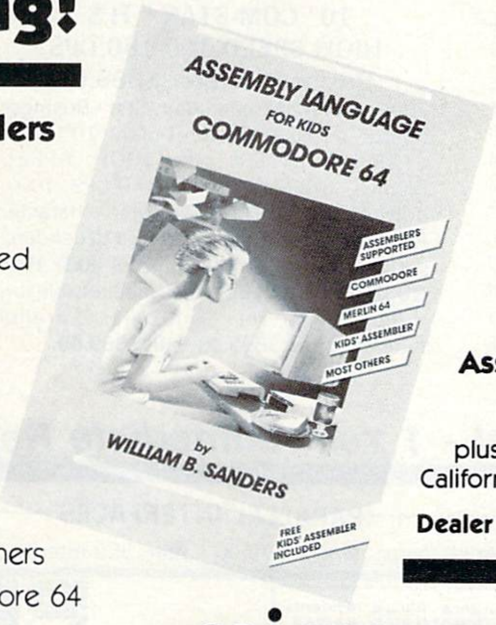
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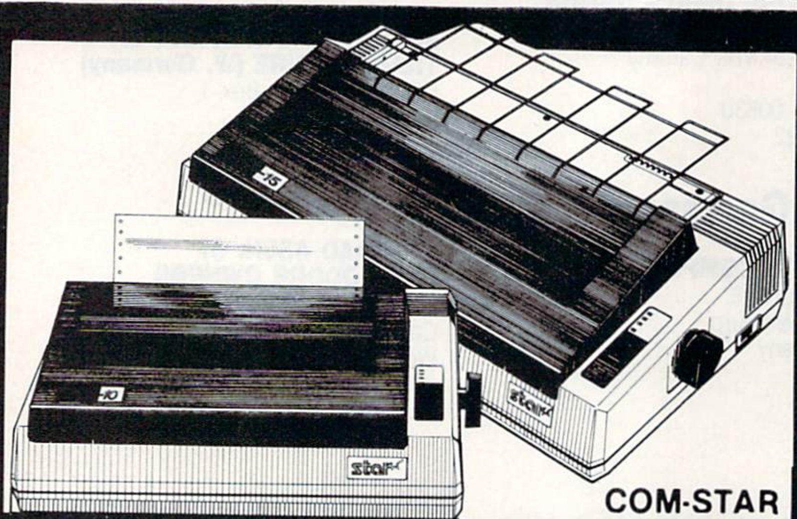

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From p. 20.

sample of one of my directories:

```
7    “1—ALPHA BUG”      PRG
25   “2—BACCARAT”       PRG
27   “3—BACKGAMMON”     PRG
58   “4—SOCCER”         PRG
17   “5—LEMONADE”       PRG
```

Cathy Allen
Roy, UT

EASY-LOAD NAMES 2—The Commodore disk manual suggests that you load a menu program as the first entry on each disk, so you can load it easily by typing LOAD“*”,8. While this is a good idea, it doesn't go far enough. If you devise a shorthand system for naming commonly used programs, you can load *any* program just as simply. When you save a menu program, just call it M. Then LOAD“M”,8 for your menu. A disk utility program could be called D, and a printer setup program, P. The wedge can be designated W.

If you use the C-64 wedge, just type @R:newname = oldname. If you haven't joined the liberated ranks of wedge users, do this:

```
OPEN 15,8,15,“R:newname = oldname”
: CLOSE15
```

Mike Martin
Phoenix, AZ

FILE CLASSIFICATION—To classify files by type, disk users often add suffixes to their names. A file might be called “ROBOT.SPR” to indicate that it's a sprite file, or “SOCCER.SYS” to show that it's in machine language.

These classifiers would be more useful as prefixes (e.g., “SPR.ROBOT”), since all similar files could then be called in one directory. Loading “$:SPR.*”, for example, would load a directory consisting only of sprite files. Here are some suggested prefixes:

DOC—Word processing document
OBJ—Assembler object file
PIC—High resolution picture
SET—Alternate character set
SPR—Sprite file
SRC—Assembler source file
SYS—Machine language program

David Wiggins
New Orleans, LA

DIRECTORY COMMENTS—Here's a tip that's been used by PET owners for years and that works just as well with the VIC and the C-64. If your program name is a short one, you can add “comments,” such as revision numbers, to it, without having them required as part of the load string.

Here's how it works. When saving the program, enter the filename, but put a shifted space, rather than the closing quotes, after its last letter. Then type your comment, ending it with the closing quote. The name, the shifted space and the comment must take up 16 or fewer spaces. When the directory is listed, the program name will be enclosed in quotes, with the comment appearing afterward.

Programs with such names can be loaded just by typing the program name. The comment can be ignored for loading purposes. Interestingly enough, you *can* have two programs with the same name, as long as the comments are different. The computer will always load the first one on the disk, unless you specify another in full, by typing “name” [shifted space] “comment”.

James R. Pring
Rantoul, IL

SAVE@ REPLACED—The 1541 disk drive's Save and Replace command (SAVE“@0:NAME”) is useful when you are developing a program, because it lets you save successive versions of the program without changing its name each time. Unfortunately, the Save@ command has a bug that occasionally causes some *other* file to be replaced with the updated program. One solution is to avoid the Save and Replace function; scratch the old program first and then save normally. This requires quite a bit of typing if a program is being updated very often. The following routine avoids the typing and the bug.

```
59999 END
60000 OPEN 15,8,15,“S0:NAME”:
CLOSE15:SAVE“0:NAME”,8
```

Whenever you want to save the updated version of your program, just enter GOTO 60000.

Jack Ryan
El Dorado, AR

IMPROVED AUTOMATIC SAVE ROUTINE—When you are developing a program and regularly putting new versions onto the disk, you can automate saving *and backing up* by using the following lines.

```
59999 END
60000 PN$ = “programname”:OPEN
  15,8,15
60010 PRINT#15,“S0:” + PN$ +
  “.BKUP”
60020 PRINT #15,“R0:” + PN$ +
  “.BKUP = ” + PN$
60030 CLOSE 15
60040 SAVE PN$,8
```

When you're ready to save your latest version, just enter GOTO 60000. Lines 60000–60020 will rename the previously saved version as a backup, and line 60030 will put the current version onto the disk. Of course, “programname” must contain eleven or fewer letters.

James Llanos
Ketchikan, AK

DISK SAVE TIP—You can save some time by combining your disk Save and Verify commands on one line like this:

```
SAVE “programname”,8 : VERIFY
“*”,8
```

David Gandariq
La Joya, TX

FINDING LOAD ADDRESSES—The following routine quickly gives the load address of any program on disk. It is particularly useful for figuring the proper SYS call for a machine language program, since in most cases the SYS call is to the first address into which the program loads. Yes, you can use pattern matching in the name.

```
55000 INPUT“NAME”;N$
55001 OPEN8,8,8,N$ : GET#8,
  A$,B$ : CLOSE8
55002 A = ASC(A$ + CHR$(0)) :
  B = ASC(B$ + CHR$(0))
55003 PRINT“STARTS AT”A + 256*B
```

Harold Miller
Clayton, GA

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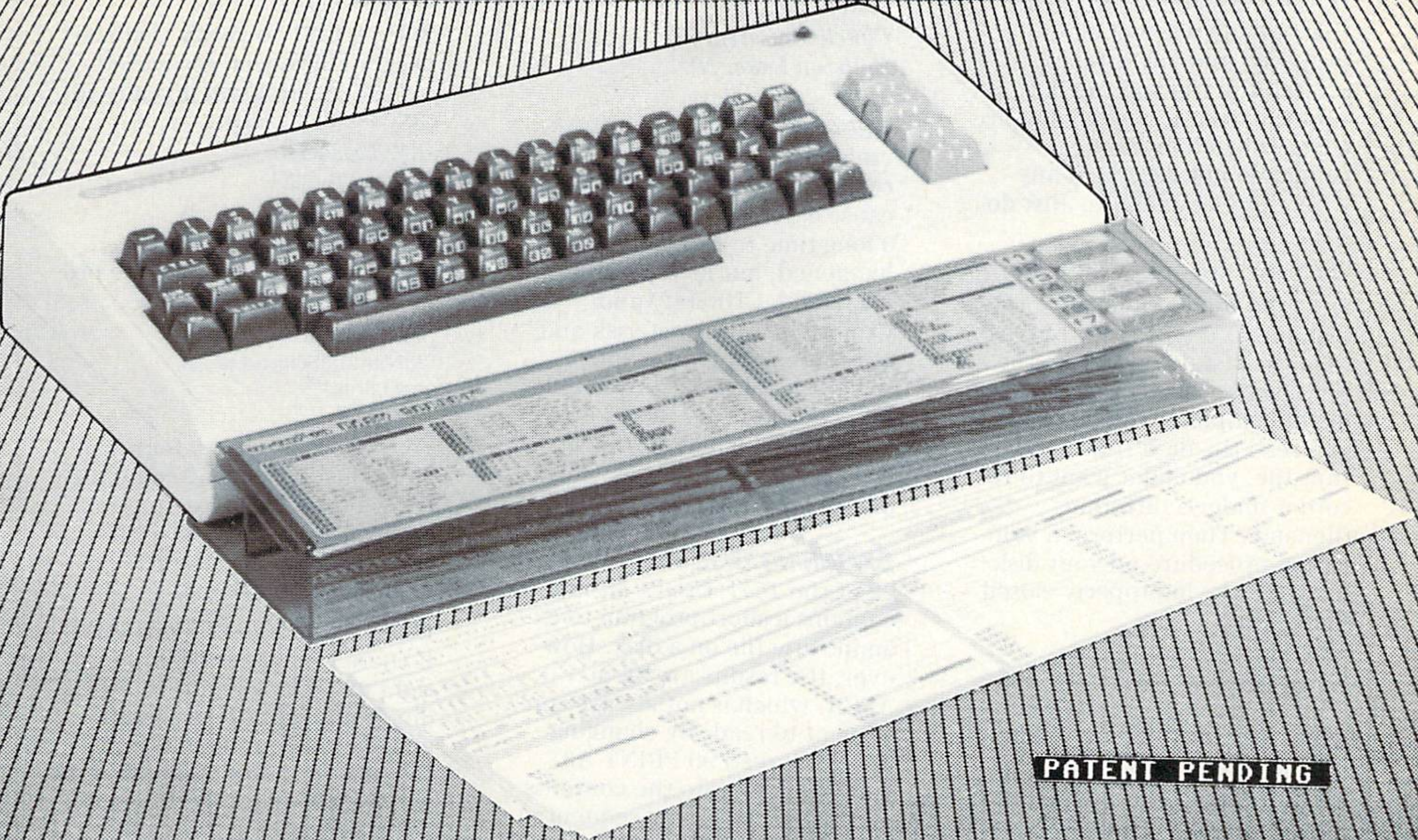

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ASTERISK DISK—Have you ever seen a disk file in your directory with an asterisk next to its file type? The asterisk indicates that the file was not closed properly, and any attempt to scratch the file will further corrupt the disk. It is possible to recover the data by using a command not described anywhere by Commodore. Just do this:

```
OPEN2,8,2,"filename",S,M
```

and read the data out in normal fashion. You won't be able to read the last data block in the file, however, because it was never completely written. After you read the data from the corrupt file, you might want to record it under a different filename. Then perform a validation procedure on your disk to delete the improperly closed file.

Tom Towle
Santa Barbara, CA

DISK FILE APPEND—A rarely mentioned feature of the Commodore disk drives (you won't even find it in the manual) is that it allows you to append data to a sequential file that already exists on the disk, without first loading the file into memory. You need only add ",A" (two characters) to your Open statement. When you then enter PRINT# to that file, the data is automatically added to the end of the existing file.

Bruce Jaeger
St. Paul, MN

FILE HANDLING PRECAUTIONS—Basic programs that work with files and string variables will behave incorrectly if the strings contain commas or colons. The cure is to write quotation marks, CHR$(34), to the file before and after the offending strings.

This problem occurs most frequently if you obtain the string data via the keyboard, using the Get statement, and if you then build that data by concatenating the characters. Comma-containing strings obtained from Data statements will also cause the problem, even if they are inside quotes in the Data statement. These quotes are not contained as part of the string itself, but are only used to control the response of the Read command.

Chuck McGaffin
Ballston Lake, NY

RELATIVE FILE BUG—When creating a relative file, using a record length of 42 or 63 will cause a Syntax error. It took me a long time to find out why this happened, but it was simple once I did. CHR$(42) and CHR$(63) are the asterisk and question mark, respectively. These so-called pattern-matching characters are illegal in Open statements for writing.

Daniel T. Lassner
Shawneetown, IL

EXAMINING DISK FILES—Page 22 of the *1541 User's Manual* contains a short program to examine any file on a disk. However, the results are all in ASCII, which is not always convenient to read. By changing line 90 to read 90 PRINT A$, you can Peek into the contents of any file, including sequential and relative files. This method is most useful when the file contains text, since it prints the text itself, rather than its ASCII equivalents.

Deb Sullivan
Pittsfield, MA

SCRATCH REMOVER—*The 1541 User's Manual* says the following form of the Load command will cause the last program accessed on the disk to be loaded.

```
LOAD "*",8
```

This command is also useful in recovering a program file inadvertently scratched, providing no other programs have been accessed from that disk since the deletion occurred. This worked very well with my VIC-20 and should work equally well for the C-64. To test this trick, try the following.

- Set up a short test program.
- Save the program to disk.
- Execute the Verify command to ensure the disk copy is all right.
- Type NEW to delete the program from RAM.
- Delete the disk version of the program.
- List the disk directory to verify the program has been deleted.
- Type LOAD "*",8
- Type LIST to verify that the program has been recovered.

Now the program is ready to save to disk again.

O.F. Brissette
Pawtucket, RI

MULTIPLE SCRATCHES—If you're tired of deleting one program at a time, try this:

```
OPEN 15,8,15
PRINT#15,"S0:progl,prog2,
prog3,prog4"
CLOSE 15
```

You can delete up to four programs just by putting commas between their names.

Todd Juen
LaCrosse, WI

DISK DISASTER PREVENTION—If there is an asterisk to the right of a filename on your disk directory, that file is corrupt and should be removed from the disk. But *don't* scratch it, or you may be courting disaster.

Instead, do a disk validation, which will remove the corrupt file. If you're using the wedge program, @V will validate your disk. Otherwise, enter the following.

```
OPEN15,8,15,"V":CLOSE15
```

Robert A. Adler
Montreal, Quebec
Canada

ERASING A DISK—Here is the simple way to erase all programs on a disk without initializing the disk again:

```
OPEN15,8,15,"N:diskname":CLOSE15
```

You must use the proper diskname, but you must *not* specify the ID characters. This process works much faster than reinitializing the disk.

John Crow
Address Unknown

LOCKING DISK FILES—Program and data files on a Commodore disk can be locked against accidental deletion or modification by using the Rename command to add a shifted space (represented here as –) as the first character of the filename. The unexpected result is that in the disk directory“–FILENAME” will become ““FILENAME. Attempts to scratch “FILENAME” will produce a File Not Found error, while attempts to scratch ““FILENAME will give an Illegal Quantity error, preventing the file from being scratched. The same holds true for all other disk commands, except those using the wild card (*), which will, of course, match anything. The locked program or file can be loaded by including the shifted space in the filename: LOAD“ – FILENAME”,8. It can be unlocked by renaming it and deleting the shifted space. This trick works on all Commodore disk drives, and with all Commodore computers.

Garold R. Stone
Annapolis Jct., MD

DISK PROTECTION—Do you want to *permanently* write-protect a 1540/1541 (or 4040) disk? With the following method, the disk will be fully readable, but absolutely cannot be written to by any 1540/41 or 4040 drive.

Byte 02 (i.e., the third byte) of Track 18, Sector 0 normally contains hex $41 (ASCII “A”) signifying 4040 format. If this byte is changed to $01, any attempt to write to the disk will fail, with error 73 DOS MISMATCH. (The $01 apparently codes for 2040 format, which is read- but not write-compatible with 4040 format.)

The following short program will do the deed, but *beware*. . .the only recovery is reformatting the disk.

```
10 REM—OPEN COMMAND CHANNEL
   AND A DIRECT ACCESS BUFFER
   (DRIVE# 8 ASSUMED):
20 OPEN 15,8,15,“I”:OPEN 8,8,8,“#”
30 PRINT#15,“UA:8,0,18,0”:REM—
   READ T18,S0 INTO BUFFER
40 PRINT#15,“B – P:8,2”REM—SET
   THE BUFFER POINTER TO DESIRED
   BYTE
50 PRINT#8,CHR$(1);:REM—CHANGE
   THE BYTE TO $01 (CAREFUL—NO
   CARRIAGE RETURN)
60 PRINT#15,“UB:8,0,18,0”:REM—
   REWRITE THE BUFFER TO THE
   DISK
70 PRINT#15,“I”:CLOSE8:CLOSE15:
   END:REM—REINITIALIZE, DONE!
```

William M. Bennett
Atkinson, NH

DISK LOCK/UNLOCK—By using a little disk magic, it's possible to write-protect a disk through software. Byte 2 of the Block Availability Map (BAM) identifies the operating system that created the disk. Normally, this byte contains CHR$(65) to indicate a 4040-type format. Changing this byte to CHR$(1) puts a spell on the DOS, causing it to think it may read this disk but not write to it. The only write command that will operate is the N0:name,id. This spell may also foil some programs that copy an entire disk.

Changing byte 2 back to CHR$(65) involves sorcery of a higher order. Suffice it to say that it is necessary to fool the disk drive in the opposite direction. The following program will lock or unlock a disk by changing byte 2.

```
  10 OPEN15,8,15:PRINT#15,“I0”:
     OPEN2,8,2,“#”
  20 PRINT#15,“U1:”;2;0;18;0:
     GOSUB1000
  30 PRINT#15,“B–P:”;2;2
  40 INPUT “(L)OCK OR (U)NLOCK”;
     A$:IFA$ = “U”THEN70
  50 IFA$ < > “L”THEN40
  60 PRINT#2,CHR$(1);:GOSUB1000:
     GOTO100
  70 PRINT#2,CHR$(65);:GOSUB1000
  80 PRINT#15,“M–W”;CHR$(1);
     CHR$(1);CHR$(1);CHR$(65)
  90 PRINT#15,“M–W”;CHR$(2);
     CHR$(7);CHR$(1);CHR$(65)
 100 PRINT#15,“U2:”;2;0;18;0:GOSUB
     1000
 110 CLOSE2:PRINT#15,“I0”:CLOSE
     15:END
1000 INPUT#15,EN,EM$,ET,ES
1010 IFENTHENPRINTEN;EM$;ET;ES
1020 RETURN
```

Kevin Hawkins
Spartanburg, SC

DISK VALIDATION—If your disk directory becomes garbled and it seems like programs get lost, try the following.

```
OPEN15,8,15,“V” : CLOSE15
```

This will make your drive whir, turn its light on and growl a bit. What it is really doing is moving your data around so it is easier to access. Your programs will be the same.

Greg Long
Portland, OR

PRINTING DISK DIRECTORIES—Page 11 of the *1541 User's Manual* gives an incorrect way of printing a disk directory. If you want to print a disk directory, just load it into memory, then use the following line, entered as a Direct mode statement.

```
OPEN4,4 : CMD4 : LIST
```

When the listing has finished, enter:

```
PRINT#4 : CLOSE4
```

You cannot use ?# as an abbreviation for PRINT#.

Jay Hegt
Staten Island, NY

ABBREVIATED DIRECTORY—You can get the disk name, ID number and the number of blocks free, without all the filenames, by using:

```
LOAD “$:”,8
LIST
```

If you use the wedge, you can get the same thing by using @$:— it won't give a Drive Not Ready error, regardless of how many times you use it.

Jeff Wisniewski
Address Unknown

SPECIAL DIRECTORY LOAD—The following command allows you to load a directory consisting only of files of a given type—PRG, SEQ, REL and so on.

```
LOAD“$:* = P”,8
```

The P stands for program, and can easily be replaced by S for sequential or R for relative. When the above command is given, and the disk in the drive contains a mixture of file types, only the Program Files will appear in the directory.

Stephen Thomas
Dodge City, KS

EASY LOAD, EASY SEE DIRECTORY—If you're using the DOS Wedge, just type @$ and you'll get the directory on the screen. Now change the color of your cursor, using [CTRL BLK] through [CTRL YEL]. Cursor up to the program you want, and type an up arrow to load and run, or a slash to load only. Press the return key and the proper action will take place, with the screen messages all in your new color, making them easier to see and read next to the other material in the directory.

If you're not using the wedge, type LOAD"$"{RETURN} and then list the directory. Change your cursor color, then move the cursor up to the program you want and type LOAD. Move the cursor past the double quote after the program name, type ,8: and press the return key. Again, the screen messages will be easier to read.

Tom Trocco
Bronx, NY

QUICK AND DIRTY DISK DIRECTORY—If you don't use the C-64 wedge, loading a directory overwrites whatever Basic program you have in memory. You can avoid the overwriting and get a semblance of a directory by loading it directly to the screen; you'll only see the filenames, the header and the disk ID number, but in a pinch this might be enough. Here's what to do:

1. Clear the screen and move your cursor to the fifth line from the bottom of the screen.
2. Type LOAD"$",8,1 {RETURN} (don't forget the ,1).
3. Move your cursor back up to the place you typed LOAD, and type POKE 53281,7 {RETURN}.
4. Simultaneously press the shift and Commodore keys.

At this point, you should see your quick and dirty directory. If your disk contains a large number of programs, they might have interfered with step 3, and the effects will be obvious. The 7 used in step 3 gives a yellow background color; you can use any color you want, as long as it allows the directory to be visible.

Curtis Smith
Pingree, ID

NO-LIST DISK DIRECTORY—You can prevent a disk's directory from being listed by saving a specially-named dummy program as the last program on the disk. When anyone tries to list the directory, the screen will clear and the message "Don't Do That!" will appear. Here's how to do it:

1. Put a one-line dummy program in memory.
2. Type SAVE"
3. Press the shift and return keys simultaneously.
4. Reposition the cursor immediately after the quotation mark.
5. Type {CTRL RVS ON} {SHIFT M}{SHIFT S}{CTRL RVS OFF} DON'T DO THAT!",8
6. Press the return key.
7. Wait for the dummy program to be saved.
8. Try to list the directory.

Don Saito, Jr.
Torrance, CA

DISK WEDGE TIP—With the Wedge utility for the C-64 or VIC, typing @$ will list the entire disk directory. If you are only interested in the disk's name and/or the number of blocks free, try typing @$:—it will give you only the first and last lines of the directory. Using this technique more than once can give a DRIVE NOT READY error, which can be easily corrected by using @$ one time.

Paul F. McDonald
Nashua, NH

C-64 WEDGE TRICKS—When using the C-64 wedge, if you hit the space bar while listing your directory, the scrolling will stop. Hitting the space bar again will resume the listing. Pressing the stop key will terminate it.

To load a program while using the wedge, just get its directory entry on screen, then press the stop key. Move your cursor to the first position on the same line as the directory entry, then type a slash or an up arrow. Press the return key, and, presto!—your program will load. If you use the up-arrow key, your program will run automatically.

Hiram Rivera
Stillwater, OK

DOS WEDGE HINT 1—Here are two easy modifications to the DOS wedge boot program. First, rename it to a single letter or symbol, to simplify typing its name. If you rename the program "!", it's about as simple to load as any program can be. Try typing "!" with one hand, while holding the shift key with the other, and you'll see what I mean.

The second hint is to add a line to the boot program, which will Poke your favorite screen and border colors, and set your favorite character color. To set up a white screen with white border and black letters, just add this line:

```
5 POKE 53280,1 : POKE 53281,
  1 : PRINT "{CTRL BLK}"
```

John Premack
Lexington, MA

DOS WEDGE HINT 2—Another possibility is to include a prompt asking the current time, and using it to set TI$. You can also put lines in the boot to send configuration commands to peripherals; I use one to change my printer's line spacing away from its default value.

Kenneth J. Plotkin
Vienna, VA

REACTIVATING THE WEDGE—There are two easy ways to reactivate the C-64's wedge program after it has been disabled by a reset or @Q command. First, you can POKE186,8 and then enter SYS52224. Secondly, you can simply enter SYS52224, then type @#8{RETURN}. This uses the DOS 5.1 command to change the device number from the default zero to the disk drive #8. Of course, if your drive has another number, you can use that number in the @# command.

Terrence Fong
Glen Ellyn, IL

VIC WEDGE TIPS—The 1541 test/demo disk, packaged with every 1541 disk drive, contains a useful program called VIC-20 Wedge. It lets you use single-key commands to find the disk status, send commands to the 1541, list the directory without overwriting programs in memory and load Basic programs. You can save this powerful program on other disks, just as you'd save any Basic program.

It's also helpful to rename it as "V" or some other easy-to-type name. For example:

```
OPEN15,8,15,"R0:V = VIC-20 WEDGE"
{RETURN}
```

If you save the renamed program on each of your disks, you'll only have to insert the disk and type LOAD"V",8 to activate your wedge.

Rita Cope
Newport, TN

SHORTER DISK COMMANDS—When formatting a disk, it is quicker and easier to type:

```
OPEN15,8,15,"N0: diskname,id"
```

than the method of

```
OPEN15,8,15:PRINT#15,"N0:
diskname,id"
```

Remember to enter CLOSE15 when finished. This tip works for other disk commands such as Scratch, Validate, Initialize, Rename and Copy.

Patrick Kurz
Tulsa, OK

C-64 DISK SPEEDUP—You can speed up the C-64's handling of disk transactions by making the screen go blank and sending a special command to the 1541. The following line makes the screen go blank and speeds up the serial bus.

```
POKE 53265,PEEK(53265)AND239 :
OPEN15,8,15,"UI-" : CLOSE 15
```

The following command returns the screen and disk drive to normal.

```
POKE 53265,PEEK(53265)OR16 :
OPEN15,8,15,"UI+" : CLOSE 15
```

This trick is especially useful and timesaving when put into programs that use disk files.

George E. Perry
Courtland, VA

PRINT# PROBLEM—When abbreviating PRINT#, you must *not* attempt to use ?# as the abbreviation. That will look fine in your listing, but it will give you a Syntax error when run. If you make that mistake, you can correct it by putting your cursor onto the listed line, then pressing the return key. The proper abbreviation for PRINT# is P{shift R}.

Mark Lemkin
Darnestown, MD

DISPLAY T & S FIX—If you use the Display T & S utility included in your 1541 test/demo disk, and are sick of watching the track and sector contents scroll off the top of your screen, modify the program by adding this line:

```
453 WAIT 198,1,1
```

With this fix, whenever you want the output to pause, just press any key except stop or shift. To resume the output, press any key again.

Charles Lavin
Coral Gables, FL

JOYSTICKS & PADDLES

JOYSTICK JOY—If you already own an Atari 2600 game system, and who doesn't, there is no need to buy joysticks for your Commodore. The Atari units will work perfectly.

Paul Goble
Mustang, OK

JOYSTICK SORROW—Joysticks can cause problems on the C-64. If the joystick is moved or the button is pressed, it can cause the keyboard to act erratically, printing different letters than the keys that are pressed. Always make certain your joysticks are unplugged or undisturbed when not in use.

Matt Bassen
Federal Way, WA

JOYSTICK SORROW UNDONE—When you write a C-64 program that uses both a joystick and limited character inputs, using the Get statement is a good way to read the keyboard. But the Get statement may incorrectly read the joystick as a character input. You can avoid this problem by using joystick port 2, or by properly choosing the characters to which your program responds. For example, {CRSR RT}, {space}, left arrow, * and 2 are characters commonly read from the joystick in port 1. Avoid using these characters and you'll have avoided a problem.

John Mirabella
Vienna, VA

JOYSTICK TRICKERY—With an Atari-style joystick in port 1, you can slow down screen printing by moving the joystick to the left. This duplicates the action of the CTRL key and is very useful when reading long program listings.

Mike Zuerlein
Casper, WY

JOYSTICK SUBSTITUTE—If you have a C-64 but no joysticks, you can simulate joystick operation from the keyboard. It's not the most convenient thing in the world, but it *does* work.

PORT 1	PORT 2
Fire—space bar	space plus M key
Up—1key	space plus f1
Down—left arrow	space plus Z key
Left—CTRL	space plus C key
Right—2 key	space plus B key

Fred Exelby
Brantford, Ontario
Canada

JOYSTICK FIRE BUTTON—In most programs that require joysticks, there are times when the player is asked to press a key to continue. If you're writing such a program, why not use the joystick's fire button instead of a key? The following lines will cause a halt in program execution until the appropriate fire button is pressed.

```
WAIT 37137,32,32  VIC-20 joystick
WAIT 145,16,16    C-64 joystick #1
WAIT 56464,16,16  C-64 joystick #2
```

These routines use very little memory compared to other similar ones, which can be very important in the unexpanded VIC, or if your program uses a lot of memory.

E.L. Hayno
Pensacola, FL

C-64 JOYSTICK BUTTON—You can use the joystick to continue the flow of a program by waiting for the button to be pressed. WAIT 56465,16,16 will work with port 1, while WAIT 56464,16,16 will work with port 2. The following simple program illustrates the principle.

```
10 PRINT "PRESS FIRE BUTTON ON
   PORT 2"
20 WAIT 56464,16,16
30 PRINT "BANG!"
40 GOTO 20
```

David Covarrubias
Thousand Oaks, CA

JOYSTICK SORROW, VIC VERSION—On the VIC, if a Datassette key is depressed, it can disrupt operation of the joystick. So always press the Datassette's stop key if you're working with a joystick.

Bosco Tsang
Windsor, Ontario
Canada

VIC JOYSTICK READER—This one-liner will read the VIC joystick port.

```
10 POKE 37154,127 : X = (NOT PEEK
   (37151)) AND 60 – ((PEEK (37152)
   AND 128) = 0) : PRINT X : GOTO 10
```

Pushing the joystick in the following directions will return the indicated values of X:

North	4	Northeast	5
South	8	Northwest	20
West	16	Southeast	9
East	1	Southwest	24

When the joystick is centered, X = 0. Pressing the fire button will return a value of 32 plus the value for the joystick direction. To have the computer wait for the user to press the fire button, use the following.

```
20 PRINT "PRESS THE BUTTON TO
   CONTINUE"
30 WAIT 37137,32 : WAIT 37137,32,32
40 Continue the program here.
```

Tony Giordano
Brooklyn, NY

VIC PADDLES—Use the paddles—it's easy! Just Peek (36872) for paddle X and Peek (36873) for paddle Y. That's all it takes to read them—very easy, compared to the joystick.

Unknown Magician
Unknown Address

VIC PADDLE PROGRAM—Plug a paddle into the VIC's control port, turn up the sound, run this program and twiddle the paddles.

```
1 X = PEEK(36872) : POKE
  36876,X : POKE 36878,X : POKE
  36879,X : PRINT "{SHFT CLR}" X :
  GOTO 1
```

John Hartenstein
Philadelphia, PA

PADDLE WAIT STATEMENTS—In other tricks, we've shown how the Wait statement can be used to stop program execution until a certain key is pressed. To wait for the paddle buttons, use the following.

```
WAIT 56321,4,4          (C-64, Port 1, X)
WAIT 56321,8,8          (C-64, Port 1, Y)
WAIT 56320,4,4          (C-64, Port 2, X)
WAIT 56320,8,8          (C-64, Port 2, Y)
WAIT 37137,144,
16                      (VIC, X)
WAIT 37152,128,
128                     (VIC, Y)
```

Grant A. Dibert, III
Ft. Thomas, KY

KEYBOARD

WISE WORDS—When typing in programs from *RUN* or other magazines, don't merely copy and run the programs. Analyze the approach and techniques used by the better programmers—you'll not only enjoy their product, but you'll enhance your own skills.

Frank Tymon
Lancaster, CA

BOOK HOLDER—To aid in typing programs from books or magazines, use an acrylic cookbook holder, available in most housewares stores. It will hold your book or magazine open at a comfortable angle, and it won't damage the binding. To keep your place on the page, clip a straightedge of some sort (a plastic ruler is ideal) to the front of the holder and move it down the page as you type.

Marion Deland
New York, NY

PAGE HOLDER—Typing programs from magazines can be exasperating when the spine of the book causes the pages to hump or flip by themselves as you type. To solve this problem, get some rubber-strip magnets and a magnet board used to help needlepoint and cross-stitch workers keep their place. The board is a sheet of enameled ferrous metal about the size of a magazine page.

They can be bought at most needlework craft stores for under $4. The one I use is made by LoRan and is 8 × 10 inches, small enough to fit inside the magazine, but big enough to cover the text on the page.

If you would feel more comfortable going to a hardware store instead of a needlework shop, you can put together your own board. You'll need an 8- × 10-inch sheet of ferrous metal, about 26–30 gauge, and a package of rubber-strip magnets.

The weight of the board, placed under the page you are typing, holds the magazine sharply flat, and the magnets, placed on the page, hold it down. The magnets can also mark your place in the text as you type repetitive areas, such as Data statements. With the board and magnets in place, you can read or close the magazine and turn the pages, without losing your spot.

Marilyn Sallee
Alliance, NE

USER-FRIENDLY TYPING—Have a friend read off the program to you while you input it.

Bill Barbiero
Flushing, NY

USE A RECORDER 1—To avoid the woozy feeling you get when looking back and forth from keyboard to magazine when typing in a long program listing, and to cut down on mistakes from losing your place, use a voice-cassette recorder. Read the program into the recorder slowly and distinctly, then play it back and type in the program as you read it to yourself!

Karen Rhodes
Orange Park, FL

USE A RECORDER 2—Hunt-and-peck typists like myself have a problem when typing in programs. With only two eyes, we have to look three places at once—the printed source, the keyboard and the screen.

I dictate my programs into a tape recorder, then play them back with the aid of headphones and a stenographer's pedal-pause switch. Now I load while only having to look at two locations. An added advantage is that I can check for bugs while reading the listing on the screen and listening to the audio tape. The saving in both time and errors is amazing.

John Bath
Darlington, Western Australia
Australia

COUNT SPACES—When typing a number of spaces in a Print statement, looking at the line just above your cursor will help you count the spaces you are entering.

Darin Hieb
Lodi, CA

ELIMINATE REMs—When typing programs from magazines or books, you can save time and memory by *not* typing the REM statements. Be careful, because sometimes GOTO statements go to a REM line. [Bad programming practice. Ed.] In these cases, just change the number in the GOTO statement to the next highest non-REM line number.

Joseph Flynn
Pearl River, NY

COUNT PARENTHESES—When typing in a program line with lots of parentheses, it's easy to leave one out. Try counting the number of parentheses—if a number is even, you've probably typed in the correct number. If it's odd, you've surely left something out.

Kris Jackowski
Wethersfield, CT

BASIC ABBREVIATIONS 1—You can fit lots of statements onto one program line by using the abbreviations for Basic keywords from the appendix of your user's manual. When the line is listed, the keywords are printed out in full, so your program line might take up more than the usual number of screen lines.

This is no problem, but if you try to edit the long line, your computer will cut it down to normal program line size. So use abbreviations to pack the statements into a line, but be *very* careful when editing it later.

Pittsburgh Commodore Group
Newsletter

BASIC ABBREVIATIONS 2—You probably already know that Commodore Basic lets you enter most keywords by pressing the first letter of the keyword then shifting the second letter. But if somebody told you that this is a good way to save memory space, then please tell them to catch the next serial bus out of town.

The Basic abbreviations are a convenient way of entering programs from the keyboard, since they require fewer keystrokes than typing out the whole word. Sometimes, they also allow you to squeeze more information into a single program line, which is generally limited to four screen lines on the VIC and two screen lines on the 64.

However, the abbreviations *do not* save memory space in the computer. When Basic receives a program line, Basic automatically converts keywords into single characters, called tokens.

For example, the token for the Print statement is 153, which is stored in one byte of memory. Regardless of whether you type PRINT (5 characters) or ? (1 character), the resulting program line will always store the instruction as one character. Thus, unfortunately, there is no saving of memory space.

And speaking of abbreviations, please remember that you cannot use a question mark in abbreviating PRINT#. The latter command is used when you want to send information to a peripheral such as a disk drive, Datassette or printer, and must specify a file number. The correct abbreviation for the Print# statement is P(shift R), which Basic stores as token number 152.

If you try to abbreviate Print# as ?#, it will be tokenized as 153 (the token for Print), followed by a 35 (the code for #). That will yield a Syntax error instead of the desired result.

There is one sneaky way around this restriction—simply type the program line using ?# and press the return key. Next, list that line, move the cursor back up to it and press the return key again. The second time, the Print# statement will be spelled out in full and will be properly tokenized.

You also have to be careful with the Get, Get#, Input and Input# statements. Get# and Input# are used to obtain data from peripherals, much as Print# sends information to them. The Get statement is abbreviated G (shift E), but that abbreviation cannot be used for Get#, which has no abbreviation in Commodore Basic.

Surprisingly, the commonly used Input statement also has no abbreviation, but the rarely used Input# statement is abbreviated as I (shift N).

Ian Adam
Vancouver, British Columbia
Canada

BASIC ABBREVIATIONS 3—When keyword abbreviations are used in long program lines, the lines can list longer than the usual 80 columns. (Prove it by entering 10?:?:?:, etc., running the question marks to a point just short of the 80th column. Then list the line—it should take up almost six screen lines.)

The long lines cannot be edited, which is annoying when they have to be changed in some way. To avoid retyping in this circumstance, make a dummy line, numbering it so it will never be executed. After its line number, make the first character a quotation mark. The rest of this line should be your regular program line, including all its abbreviations.

When you need to edit your regular long line, just list the dummy, edit the line number, delete the leading quotation mark, edit the rest of the line, then hit the return key. Your dummy remains if you need it again, but your newly edited line replaces the one you couldn't edit before, with a saving of many keystrokes. You can delete the dummy when your program achieves its final form.

Lion L. Kuntz
San Francisco, CA

BASIC ABBREVIATIONS 4—Proofreading Basic lines that contain keyword abbreviations is easier if the computer is in Upper-/Lowercase mode. In this mode, abbreviations don't contain graphics characters and are much easier to read. Poke is pO, Next is nE and so on. You can put your machine into this mode by simultaneously pressing the shift and Commodore keys.

Maurice A. Gage
Westchester, CA

ABBREVIATING ZERO—When a variable is assigned the value zero, such as in the statement A = 0, the zero character can be replaced by a decimal point. The computer will interpret the decimal point as a zero, and will evaluate the expression about 20% faster than if you had used the zero character.

You can use this trick wherever a zero is needed by itself, but not when the zero is part of another number, like 1000.

The Transactor

ABBREVIATING RUN—If you have a program in memory and want to run it, you don't have to type the word RUN. Just type in any letter or letters (not numbers), then hit the shifted run/stop key. Your program will run for you.

The PET Gazette

ERROR MESSAGE—There have been reported mysterious occurrences of the Out Of Data error when editing and fiddling about in general. This is not a bug, but is due to pressing Return while the cursor is over the Ready prompt. The machine interprets this as READ Y, and since there is usually no corresponding Data statement to the Read command, we get the error.

The Transactor

EASY DATA STATEMENTS—When entering Data statements, keep one finger on the comma key, and use the other hand to enter the numbers. Then you won't have to fumble for the comma key after every data item.

Bill Barbiero
Flushing, NY

EASY POKES—A fast way to Poke a zero in Direct mode is by typing POKExxxx, then rolling your finger off the comma key onto the period, then pressing the return key.

The computer interprets the period as a zero, and you've saved a few thousand microseconds of finger fumbling.

Robert A. Adler
Montreal, Quebec
Canada

EASY RVS—If you are a one-handed typist, you know that it's difficult to use the CTRL RVS key, because it slows you down. Well, now you need only one hand, and you don't have to stretch clear across the keyboard.

Just press the CTRL and R keys. It works in or out of Quote mode, and it's very handy if you are using your hand to spot text on a listing.

Doug Hanley
Las Vegas, NV

EXTRA C-64 COLORS—All 16 Commodore 64 colors can be called up from the keyboard, but only eight of them are marked on the keys. If you put a 6-inch piece of masking tape above the number keys 1–8, you can mark it with the other colors to make your life easier.

The colors are called by pressing the Commodore Logo key simultaneously with a number key. From left to right, they are orange, brown, light red, dark gray, medium gray, light green, light blue and light gray.

L.F.S.

EASY RVS OFF—Whenever you press RVS on and want to shut it off, you can press Return instead of pressing RVS off.

Erik McMenamin
New Haven, CT

C-64 CONTROL KEY—The C-64's CTRL key can be used with letter keys to provide some interesting results. Here are some examples:

CTRL-H	Disable case switch
CTRL-I	Enable case switch
CTRL-N	Switch to lowercase
CTRL-R	RVS ON

(Case switch is the ability to switch upper/lowercase with the shift and logo keys.)

If you look at the table of CHR$ codes in your user's manual, you'll be able to see what's happening. CTRL-A is equivalent to CHR$(1), CTRL-B to CHR$(2), etc. Since N is the 14th letter of the alphabet, CTRL-N is equivalent to CHR$(14). The technique works for CHR$(0) through CHR$(31), and can be useful in sending control codes to printers, modems and the like.

Eric Sink
Morris, IL

INST/DEL KEY TIP—If you're not an excellent typist, odds are that the most used key on your keyboard is the INST/DEL key. Take one of those self-adhesive rubber feet that are sold in electronics stores, and stick it on top of the INST/DEL key. Now you can stab for it blindly, and hit it any time, *without* accidentally hitting the CLR/HOME key located next to it!

Bruce Jaeger
St. Paul, MN

HITTING THE HOME KEYS—With all the keys on the Commodore keyboard, it's easy for your fingers to miss the home keys for touch typing. If you put drops of glue on the F and J keys, you'll be able to feel them when your hands are positioned correctly. Choose a type of glue that will make a substantial bump, but one that can be scraped off later, if need be.

James Bartlett
Summerville, GA

EXITING QUOTE MODE—The so-called "Quote mode" can be maddening when your computer is in it, and *you* want to be out of it. You can usually get out of Quote mode by typing another quotation mark, then deleting it.

But sometimes that doesn't work, such as when you're filling in the spaces opened up by the insert key. Those spaces behave as though the Quote mode were active, even when it isn't, and typing another quote won't change anything. If you press any cursor control key when you're on an inserted space, you invariably get the Quote mode version of that cursor control, which is often not what you want. When you try to delete it, you get the reverse field T instead, which of course puts you deeper into trouble.

The solution? Press shifted return, which moves the cursor to the next line without "entering" the line you are changing. It also kills the Quote mode on the inserted spaces, so you can put your cursor back up there and do whatever you please.

Tom Fetherston
Fairdealing, MO

ESCAPING FROM QUOTE MODE—The Exiting Quote mode trick gave some suggestions for breaking out of the Quote mode, which you enter after using the insert key. (In the Quote mode, the cursor control keys don't work as you'd often like them to.)

Another way out is to use your space bar to fill the inserted holes with space characters. Then you can type, delete and move your cursor to your heart's content.

Roberta London
Houghton, MI

CURSOR CONTROLS—Not being a very good typist, I often leave the cursor-control characters out of my Print statements. (I mean the reverse field heart, the reverse field Q, etc.) We all know you can't print those characters unless you're in Quote mode, but there's nothing to worry about here. Just put your cursor on the character to the right of the missing ones, and press the insert key the appropriate number of times. The spaces so inserted are already in Quote mode, so any cursor keys you press will show up in their Quote mode form.

If you wish to place a cursor control at the very end of a line, just put your cursor over the closing quote and use the above trick.

Bill Moffatt
Bartow, FL

ENTERING SIMILAR LINES—It's common to find several identical lines within a program. There's an easy shortcut to typing them in. Say you're entering a program in which lines 30 and 70 are the same. Once you've typed in line 30, move the cursor over to the 3 in line number 30. Now simply change the 3 to a 7 and press the return key. You've just entered line 70 without destroying 30. Type LIST and see.

This technique can also be used to simplify the entering of lines that are similar but not identical. Instead of just changing the line number, you'll have to change whatever makes the lines different, then press the return key.

Randy Thompson
Eugene, OR

RESURRECTING DELETED LINES—If you've just accidentally deleted a line and the full line is still on the screen, just move the cursor up to the line number and press the return key. The line will be added back into the current program in memory, at the appropriate position.

Glenn Davison
Aurora, CO

MOVING PROGRAM LINES—If you need to move a line from one place in a program to another, first list the line you wish to move; next, move the cursor up to the line number and type the new line number over the old one; then press the return key. Finally, delete the original line by typing only the line number and pressing the return key.

Caution: If the new line number is longer than the original line number and its following space, you'll have to add spaces to the beginning of the line before you type in the new line number. The original line will automatically return to its original format.

Glenn Davison
Aurora, CO

ENTERING LONG LINES—Entering the 80th character on a C-64 program line (or the 88th on a VIC line) can be mighty frustrating. As soon as you type it in, the cursor jumps down to the next line, where pressing the return key fails to enter what you just typed.

There are two ways around the problem. The first is simply to move your cursor back to the program line, then press the return key. The second is to leave out some character short of the 80th, such as character number 75. Then, after you're done with number 80, the cursor will still be on the line you want. Just move it back to where you left out the character, use the insert key to open up a space and type in the missing character. Then, when you press the return key, the line will be entered perfectly into memory.

Philip J. Ternes
Bismark, ND

FUNCTION KEYS—Using the function keys can be greatly simplified by setting string variables equal to the CHR$ codes early in the program. When you need the function keys later on, all you have to do is use the proper variable.

For example, put these lines at the beginning of the program:

```
10 F1$ = CHR$(133):F3$ = CHR$(134):
   F5$ = CHR$(135):F7$ = CHR$(136)
20 F2$ = CHR$(137):F4$ = CHR$(138):
   F6$ = CHR$(139):F8$ = CHR$(140)
```

Then, when you use a Get routine, it can look like this:

```
1000 GET A$: IF A$ = "" THEN 1000
1001 IF A$ = F1$ THEN xxx
1002 IF A$ = F2$ THEN yyy
1003 IF A$ = F3$ THEN zzz, etc.
```

This technique helps reduce errors and debugging time, since you enter the character codes only once, and the numbered variables make it easy to tell which function key triggers which program branch.

Landon White
Des Moines, IA

REPEATING KEYS—On C-64 or VIC, POKE 650,128 makes all VIC or C-64 keys repeat, just like the cursor keys. POKE 650,127 disables repeat of all keys, including cursor and space. POKE 650,0 returns things to normal, which means that repeat is enabled on the space bar, and the CRSR UP/

DN, CRSR RT/LF, and INST/DEL keys.

Rob Jacob
Jones, MI

KEYBOARD DISABLE—On the VIC or C-64, POKE 649,0 will disable the keyboard until a POKE 649,10 enables it again.

Doug Spets
Springfield, IL

CHARACTER SET SWITCH DISABLE—To prevent the user from switching between the graphics and lowercase character sets, just enter POKE 657,128. This will disable the use of the shift/Commodore key combination. POKE 657,0 will enable it again.

Joe Paydarfar
Chapel Hill, NC

DISABLING STOP, ETC.—Many people have written about their ways of disabling the stop key and other features. We want to pass them along to you, but we'll precede them with a caution: Anything involving Pokes to locations in the operating system also involves a risk of unwanted side effects and possible system crashes. We've tested these tricks, and they seem to work fine, but be aware that they may play tricks of their own under some circumstances. In other words, we're talking strong magic here. For the VIC-20:

POKE 808,114 disables the stop key, but the stop/restore key combination continues to work.

POKE 808,100 or POKE 808,127 disables Stop, *and* Stop/Restore *and* List.

POKE 808,112 returns the above to normal.

POKE 818,73 : POKE 819,245 disables the Save command. Stop/Restore, unless disabled as above, enables Save again.

POKE 775,0 disables the List command.

POKE 775,199 enables it again.

For the C-64:

POKE 808,239 disables the stop key, but the stop/restore combination continues to work.

POKE 808,225 disables Stop *and* Stop/Restore *and* List.

POKE 808,237 returns the above to normal.

POKE 775,200 disables the List command.

POKE 775,167 enables it again.

L.F.S.

MODEMS & TELEPHONES

COMMODORE 1600 MODEM TIP—If you experience intermittent problems with this modem, try resoldering the pc board where the connector joins it. No stress relief was provided in that area, so after repeated removal, the electrical connection may become loose.

Tom Hoppe
Spokane, WA

TELEPHONE TIP—When you're using a modem, outside sound must not invade the phone line during data transmission. If it does, the modem will hang up, or data will be lost. Unfortunately, the popular *call waiting* telephone service causes this sort of problem when it signals incoming calls.

I've solved the problem by using *call forwarding* whenever I'm on the modem, forwarding all my calls to a time/temperature number or some other harmless destination. Forwarding the call disables the call-waiting tone, giving uninterrupted use of the modem. If you're uncertain about the use of these services on your own line, just ask your telephone company about them.

David W. Martin
Valrico, FL

PHOR PHONE PHREAKS—If you want to use a modem, but only have an old-style dial phone, here's a way around the problem. You must have touch-tone service, and you must own the dial phone. Disconnect your phone and remove the screws holding the bottom plate to the base. Trace the wires from the receiver cord to the bus bar in the base. Cut off one end of the modular extension cord you purchased, strip the four wires and match the colored wires to the wires on the bus bar coming from the receiver. Reassemble the phone.

Donald J. Ennis
Louisville, KY

MORE PHOR PHONE PHREAKS—With more than one phone on a line, family members can unknowingly pick up extensions while you're using your modem, causing undesirable errors. To avoid this problem, you can make your computer phone, or modem, the priority station.

In most cases, the wire feeding your computer phone has four conductors, but only the red and green are active. Without disconnecting them from your phone, wire these two through a double-pole switch, and back to the two extra conductors (usually yellow and black). This will take the dial tone back through the wires to the entrance bridge, the connecting block where the phone wire enters the house. At the bridge, remove all wires going to telephones, except the two going to the computer phone. Then hook the disconnected wires to the yellow and black wires coming from your switch. If your extension phones won't break the dial tone after this is done, simply reverse the yellow and black wires.

Now you can use your switch to disconnect all extensions while you're using your modem.

Gerald Evans
Westminster, MD

MODEM TIP—The following one-line program sends any program in memory through the modem at 300 baud. You can use it to send programs to your friends. Just get in communication with a remote modem, then type, in Direct mode:

```
OPEN 1,2,0,CHR$(6) : CMD1 : LIST
```

When the program has been transferred, enter PRINT#1 : CLOSE1.

Shawn Thompson
Address Unknown

POWER SUPPLIES

POWER SUPPLY TIP—The Commodore power supply is very sensitive to overheating, and needs a good flow of air around and through it to keep it cool.

Although the unit is shipped with a long cord, and the literature says to keep it a far distance from the cassette drive, computer and monitor, *never* put the power supply on the floor, especially a carpeted one. The unit will sink into the pile of a rug or carpet, blocking the cooling vents on the bottom. Even hardwood floors are dusty, and a dust-clogged power supply is a candidate for failure. Do yourself a favor and put the power supply up on a table where you can see it, and periodically dust it and check for clogged vents.

Joseph A. Levine
Lynchburg, VA

MAGICAL POWER SWITCH—Tired of plugging and unplugging your power supply every time you use it? Just get an in-the-cord switch of the type used for table lamps, and wire it into your power supply. Most of the switches are made by Leviton, and are available in hardware and lighting stores. They're very easy to install, and they make life a *lot* easier.

Steven D. Jackson
Caldwell, ID

A CONSTANT SOURCE OF POWER—If you experience the frustration of having your power cord fall out right after you've typed in 500 lines of code, try this tip. Glue your power cord into the power connector with clear silicone rubber. It won't change the appearance of your machine, and the rubber can be easily removed if necessary in the future.

Tom Hoppe
Spokane, WA

POWER BOX—Every computer owner should use a multiple-outlet power box, of the type that has a single switch controlling all the sockets. In spite of what you may read in the manuals about turning on certain pieces of equipment before others, using a power box almost never causes any trouble.

Consider the advantages: All your equipment is powered from a single wall socket; you can turn everything on or off with one switch; every power cord is run to the same place; often these boxes include a protective circuit breaker. All in all, the power outlet box is one of the most useful computer accessories you can have. Ask for one for Christmas.

Ed Moore
Portland, ME

PRINTERS

PRINTER SWITCHES—When you set up a non-Commodore printer to work with your Commodore system, two things are important. First, your interface must allow full emulation of all the Commodore printer commands; most of the available interfaces do this with no problem. Second, the little DIP switches on the interface *and* on the printer must be properly set.

The interface switches are often properly set at the factory and are usually well covered in the documentation. The printer switches, however, often are *not* set properly for your Commodore, since most printers are made to function with a more industry-standard type of interface. The printer manual usually tells all about the DIP switches and their function, but the information may be hard to dig out. Persevere, and everything will work out in the end.

Tom Rohrer
Dimondale, MI

DIP SWITCHES—Most printers and interfaces, as well as many other computer peripherals, have a group of DIP switches to configure them for different types of operation. These are tiny switches, often seen in groups of eight or so, that must be set with a pen point, paper clip or other small instrument. Usually their settings determine the behavior of the device when power is applied—in the case of a printer, one of the DIP switches may determine the number of characters per inch, and another may determine whether or not the printer requires a separate linefeed character to advance the paper.

The various switch settings are always covered in the manual, but the brief descriptions can be cryptic to the newcomer. Often, the parameters that the DIP switches control can be changed later under software control, say by sending a special control character to the printer.

People often wonder why they're called DIP switches. It's because they are made with the same pin size and spacing as IC chips—they'll fit perfectly into standard IC sockets. The standard IC pin scheme, a dual line of precisely spaced connections, has a name. It's called the Dual In-line Package, or DIP. Since the switches are made to the same measurements, they've taken on the name.

Matthew A. Henson
Maryland

PRINTER PAPER HOLDER—You can have a very attractive and efficient paper feeder for your printer by buying a plastic in/out basket from an office supply store. Simply put its opening towards the back of your desk and set your printer on top of the basket. Put your fanfold paper in the basket and feed it up to the printer. The paper will unfold itself, page by page, as the printer needs it. I bought my basket in a smoke color, which matches my printer's dust cover.

Ron Reynolds
Sylvania, OH

PAPER JAM HINT—When your printer paper jams, spray some silicone or Teflon lubricant in the paper-feed pathway, then slide some paper through to clean off the excess. It will help your paper feed smoothly without binding.

Tom Hoppe
Spokane, WA

TEARING PRINTER PAPER—When I try to tear the paper off my printer, sometimes I get a sloppy edge, or even half a sheet of paper, crudely ripped down the middle. To solve the problem, I took the metal cutter off a box of aluminum foil, leaving some of the cardboard attached, and glued it to the back cover of my printer. It gives me a neatly torn edge every time.

Signature illegible
ZIP code 14864

PRINTER PAPER ALIGNMENT—The following little program will verify that the printer is properly aligned on the first line of print on a page.

```
10 REM ALIGN PRINTER
20 OPEN 4,4 : B$ = “*****”
30 FOR I = 1 TO 66
40 PRINT#4, I; B$
50 NEXT
60 CLOSE 4
```

On the VIC-1525 printer, place the top of the black plastic printer tab just above the bottom of the last hole on a page and run the program. Run it again if necessary until proper line alignment is obtained.

Jorge R. Gonzalez
Miami, FL

HOMEMADE FANFOLD—When we want to use a few sheets of special paper in our printer, we sometimes tape them together like fanfold, so we don't have to stop printing at the end of each sheet. Finding a tape that was thin and tenacious enough to do the job but that wouldn't tear the paper when removed wasn't an easy task, but we did it. The perfect printer tape is the pink hair-setting tape that's available in any Health and Beauty Aids department.

Dion and Carlos
New York, NY

EXTENDING RIBBON LIFE—Printers like the Commodore 1525 use a ribbon cartridge that inks itself as it goes. If you print a lot of graphics or reverse field characters, the inking process can fall behind, leaving you with very light print. The following program runs your ribbon continuously without printing anything; after five minutes or so of this activity, your ribbon should be thoroughly inked. If you do this from time to time, the ink may last as long as the ribbon.

```
1 OPEN 4,4
2 PRINT#4,CHR$(15)“[38 spaces]”;
3 PRINT#4,CHR$(15)“[38 spaces]”
  CHR$(8) : GOTO 2
```

Donald H. Butler
Waterford, PA

RIBBON REJUVENATION—When the ribbon in your VIC 1525 printer begins to run out of ink, you can revive it with stamp-pad ink. Of the two capsules through which the ribbon runs, one lets the ribbon pass more freely. Pry that one open with a small knife. The foam rubber cylinder is the ink holder. Dab ink all around the top of it with the brush from the ink bottle. After you reload it, run the printer awhile to even out the ink distribution.

Another option is to buy a new, identical ribbon at Radio Shack. Catalog #26–1424, for the TRS-80 Line Printer VII, fits the Commodore 1525 exactly, and is easier to come by than the same product under the Commodore label. It bears a manufacturer's product number 10A1, and may be available under other labels.

Gregory Warnusz
St. Louis, MO

RIBBON REINKING—Some of you have recommended reinking printer ribbons as a money-saving measure, but it could ruin your print head. Many stamp-pad inks contain microscopic abrasive particles that can cause more damage than I like to think about. You should use ink that is made *only* for a dot-matrix head; this type has a lubricant in it to reduce wear.

Joseph H. Walters
Bellflower, MO

DOUBLE-SPACED LISTING—The usual single-spaced program listing doesn't leave much room for notes and additions on the printout. A double-spaced listing would often be preferred, and is very easy to get with the VIC or C-64. Just use a file number greater than 127 in the Open statement for your printer, and the computer will send an extra linefeed after every carriage return. For example:

```
OPEN 128,4 : CMD 4 : LIST
```

will give the listing, then

```
PRINT#128 : CLOSE 128
```

will unlist the printer and close the file.

David Ratliff
Magee, MI

EASY PRINTER LISTINGS—I use this routine at the end of any long program I'm working on. It lets me do a hardcopy listing just by typing RUN10000. When the listing is finished, I just press the return key to disable the printer.

```
10000 PRINT “[SHFT CLR][CRSR DN]
  PRINT#4:CLOSE4[CRSR UP]”
10010 OPEN4,4:CMD4:LIST
```

Charles Christensen
Aurora, IL

USE CHR$ CODES—When you know you will be making a printed copy of a program you are writing, use character codes (CHR$) for such functions as Screen Clear and CRSR DN, so your printout will not be muddled with unreadable black dots.

Screen Clear, for example, would be PRINTCHR$(147). It may cost a bit more memory, but it will make your program easier to read and debug.

D. Mataconis
Piscataway, NJ

SCREEN DUMP—The following short program works on a C-64 with an Alphacom printer, but should also work or be easily adapted to other printers.

```
10 OPEN4,4,7:FORN = 1024TO2023:
   P = PEEK(N)
20 IFP < 32ORP > 95THENP =
   P + 64:GOTO40
30 IFP > 63ANDP < 96THENP = P + 32
40 PRINT#4,CHR$(P);:NEXT:CLOSE4
```

In the Open statement, the 7 calls for Upper-/Lowercase mode. An 8 here will print the Uppercase/Graphics mode. The If. . .Then statements convert screen codes to ASCII codes.

The program can be typed in or loaded and then run off the screen with the cursor. Compose anything you desire on the screen, type RUN and hit the return key. Remember, if the Run command is on the last line, it will scroll everything up one line.

This program works well when added to “Spriten Up!” (*RUN*, February 1984) to make a hard copy of the sprites you design.

David Lutz
Cave Creek, AZ

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dump the contents of your screen to your printer at a moment's notice, then the following one-liner is for you.

```
5678 OPEN3,3 : OPEN4,4 : PRINT
  {HOME} : FOR I = 1 TO {n}:
  GET#3,A$ : PRINT#4,A$; : NEXT :
  CLOSE3 : CLOSE4 : END
```

Make [n] equal to 1000 on the C-64 and 506 on the VIC. You may have to abbreviate some Basic keywords to fit the program into one line.

Charles Lavin
Coral Gables, FL

1526 with Single Sheets—One advantage of the Commodore 1526 printer is that it can be used with single sheets of paper. But you may not get as many lines on a single sheet as you do when you use fanfold paper and tractor feed.

When you get towards the bottom of the single sheet, the printer will stop, with the lighted paper-advance button flashing an Out of Paper warning.

To get the rest of your lines on the paper, simply slip a blank sheet in the paper feed behind the sheet you're printing to. Make sure the left side lever is set to the friction position and feed the spare sheet as far as you can. Now press the blinking paper-advance button. Printing will continue, and you'll have all your lines on a single sheet.

Don Morgan
Parsippany, NJ

1526 Printer Lockup—When using the 1526 printer and the 1541 disk drive, there is a tendency for the disk drive to hang up with a Searching for XXX message on the screen. Nothing seems to help except turning the system off and back on.

I've found the trouble to be with the sequence in which the various units are turned on. The manuals recommend you turn the computer on last, but if you have this problem, disregard the manuals and turn *the printer* on last. For me, that is the secret to avoiding disk hangups.

Barney H. Roberts
Huntsville, AL

VIC and the 1526 Printer—The 1526 often hangs up in mysterious ways when used with the VIC. To cure the problem, enter SYS 64490, which changes the timing on the serial port to match that of the C-64. Without the SYS call, the VIC sometimes fails to recognize the presence of the printer, hence the Device Not Present message.

Howard M. Mesick
Hartley, DE

RS-232 Printer Tips—Most printers that use Commodore's built-in RS-232 interface work fine for program listings, but using them in a program is a different story—they don't work well unless you follow a few guidelines.

First, if CLR is used in the program, it should be used before the printer channel is open; unfortunately, CLR closes the printer channel, and trying to access the printer will give a Device Not Present error.

Second, the first line of your program (or after the CLR) should open the RS-232 port to include the baud rate. This information should be found in your printer manual.

Third, don't close the printer channel until you want to end the program.

Chris Poole
Niceville, FL

Alphacom Printer Fix—The paper on the small Alphacom 40-column printer has a troublesome tendency to feed back into the paper compartment, leading to paper jamming in the print-feed mechanism. You can avoid the problem by placing a small piece of tape over the cover slot and onto the rear of the printer base. If you place the tape correctly, it won't interfere with opening and closing the lid.

Mark W. McCann
Montrose, MI

Printer Substitute—Do you lack a printer to review a Basic listing or network session? If you own a VCR, tape your material and review it at slow speed or in Freeze Frame mode. If you press the CTRL key while listing the program, you'll get a better video recording by slowing down things at the computer's end.

Steve Cunningham
Lynwood, CA

RESETS

Cold Starting—To cold start a VIC-20, use SYS 64802. To cold start a C-64, use SYS 64738. (Cold starting is the same as turning the computer off then on but saves wear and tear on the hardware.)

Scott Killen
Charleston, SC

Reset Buttons—One thing that many people like to add to the VIC and C-64 is a reset switch. The reset line comes out to several connectors on both machines, and if you rig a momentary switch to ground it, you'll have a reset button. The preferred approach is to wire the switch to a separate connector, which you plug into the machine as needed. The undesirable alternative is to solder a switch directly to the computer. This may make it hard to get repair service, should you ever need it.

Resetting either machine restarts it with the familiar bytes free message, which you see when you first turn on your computer. Basic's pointers are reset to their power-up values, but user memory isn't disturbed. So a reset gets the computer out of any bizarre states you've put it in, and gives you a chance to recover your program. You have three choices on connecting the switch.

First, on either machine, between pins 2 and 6 of the serial I/O port. This is a good choice, because the connector can be inserted only one way, and because this port is available on the computer *and* on the disk drive, if one is connected.

Second, on either machine, between pins 1 and 3 of the user I/O port. This is less desirable because some user port connectors can be inserted upside down, wiring your switch to an unintended, potentially disastrous, place.

Third, between pins A and C of the C-64 expansion slot, or between X and Z of the VIC expansion slot. Depending on your connector, this method may or may not share the hazards of the one above.

Tom Hoppe
Spokane, WA

UNNEW PROGRAM—The trick above showed several ways to attach a reset button. Reset stops program execution, returns all internal pointers to their power-up values, and brings the Bytes Free message to the screen. It has the same effect as turning the computer off, then back on, except that memory is not erased. Resetting the pointers makes it *seem* as though Basic programs are erased, but they are still there, where an UNNEW program can revive them. Judging from our mail, many readers don't know about UNNEW programs.

The Basic program listed below creates a machine language UNNEW program that resurrects Basic programs after a Reset or a New command. It works with a disk drive; if you want a tape version, change the 8 in the last part of line 20 to a 1.

To add UNNEW, enter and run our program. If you've made a critical typing mistake, you'll get an error message. If you don't get one, delete lines 1–3, then save the remaining lines as UNNEW BASIC. Run the program again, and it will automatically make and save a machine language program named UNNEW 525. When you need to use the UNNEW program, enter LOAD"UNNEW 525",N,1 (where n = 8 for disk or 1 for tape). When the load is finished, enter SYS525:CLR and your program will reappear.

L.F.S.

```
1 FORI=1TO53:READX:CS=CS+X:N
  EXT
2 IFCS=6918THENPRINT"OK-DELE
  TE LINES 1-3":END
3 PRINT"ERROR IN DATA STATEM
  ENTS":STOP
10 FORA=525TO577:READD:POKEA
   ,D:NEXT
20 POKE43,13:POKE44,2:POKE45
   ,66:POKE46,2:CLR:SAVE"UNN
   EW525",8,1:NEW
30 DATA 160,{2 SPACEs}3,200,
   177, 43,208,251,200
40 DATA 200,152,160,{2 SPACE
   s}0,145, 43,165, 44
50 DATA 200,145, 43,133, 60,
   160,{2 SPACEs}0,132
60 DATA{2 SPACEs}59,162,{2 S
   PACEs}0,200,208,{2 SPACEs
   }2,230, 60
70 DATA 177, 59,208,245,232,
   224,{2 SPACEs}3,208
80 DATA 242,200,208,{2 SPACE
   s}2,230, 60,132, 45
90 DATA 164, 60,132, 46, 96
```

SOFTWARE RESET BUTTON—Do you need a reset button for your C-64 or VIC-20 but don't have the money to buy the hardware? Good news—you can have one absolutely free! To use the restore key as the reset button, do the following.

```
POKE 792, PEEK(65532)
POKE 793, PEEK(65533)
```

This establishes the NMI vector in RAM to be the same as the reset vector. The only drawback is that as soon as you use the restore key as the reset button, the NMI vector gets restored. So, after every use, perform the two Pokes again to reestablish the restore key as the reset button.

Bobby G. Roberts
North Highlands, CA

RESTARTING PROGRAMS—Sometimes a program will crash unexpectedly after you've entered a lot of valuable data—you may have hit a bad bit of code, forgotten to connect a peripheral or done something else that you can avoid or correct next time. The problem often arises that you want to get back into the program without losing your data, but CONT won't execute for some reason, and Run will reset all your variables.

The secret to starting in the middle is using GOTO in Direct mode to return to a specific point in the program. Unlike Run, GOTO has no effect on variables by itself. Possible entry points include the very beginning (unless it initializes the variables you want to protect), a menu display or the routine you got kicked out of.

Some cautions: Making any changes to program lines will wipe out your variables, so save your data before correcting any bad sections of code. Depending on where you reenter the program, some variables could be changed. If you understand the program thoroughly, you can use the GOTO command, which will avoid this. If not, you should consider starting over from the beginning.

Howard M. Mesick
Hartly, DE

MORE C-64 RESETS—SYS 64767 resets the computer without changing the existing screen colors. SYS64760 seems to do a full reset, but it's much faster than the standard SYS64738.

Gerald Burrell
Chicago, IL

ANOTHER VIC RESET—Instead of using SYS64802 to reset your VIC, try SYS64820. It seems to work much faster, and it keeps TI$ intact.

Sean Lockhead
Philadelphia, PA

SX-64 COMPUTER

SX-64 BLANK SCREEN—Since the default colors of the SX-64 are different from those on the C-64, the screen sometimes appears blank, when all that is wrong is the cursor color. I've made a sign saying CHANGE COLOR, to remind me of the problem. I've also put a big black dot on my disk labels, to remind me to change the cursor to black before I run the programs on my SX-64. This way, I'll be able to read the choices on my disk menu.

Macey B. McKee
Macomb, IL

SX-64 OPERATING HINT—On the SX-64, the shifted run/stop key loads and runs the first program on disk, rather than on tape. This is a nice feature, but it lacks the built-in protection provided by having to press Datassette buttons. In fact, it's rather easy to accidentally hit the shift and run/stop keys, causing the program in memory to be overwritten by something from the disk. This can be especially disastrous when the overwritten program is some new creation that hasn't yet been saved.

To avoid this problem, I leave the disk out of the drive when I'm programming, except when I'm ready to save my work. With the disk out of the drive, pressing the shift and run/stop keys gets only a File Not Found error, and the program in memory remains intact.

David J. Todeschini
Richmond Hill, NY

SX-64 Printer-Interface Hint—Some C-64 add-on devices, notably Cardco printer interfaces, pick up their power by plugging into the cassette port on the rear of the computer. Because the SX-64 portable computer doesn't have a cassette port, it's not possible to use a standard Cardco cable with it. We solved this problem by cutting off the connector that goes from the interface to the cassette port. We then obtained a 9-pin subminiature D connector and soldered the former cassette port wire onto pin 7. Now we can plug the connector into one of the game ports, and the interface picks up its power from there. Our printer (Epson MX-80) runs fine, and the other game port is free so we can still use a joystick with programs like Commodore's Magic Desk.

Kris & Steve Coon
Honeoye, NY

VIC MEMORY EXPANDERS

VIC Memory Expansion—The VIC1110 8K RAM cartridge is set up to allow easy, inexpensive expansion to 16K. If you're reasonably experienced in electronic assembly work, you might want to try this project.

1. Open the plastic case by removing the screw from the bottom and by gently prying loose the four plastic catches. Two of the catches are inside the narrow slots at the bottom rear of the case. The other two are on each side of the wide front slot.

2. Inside, you'll see a printed-circuit board with four 24-pin integrated circuits, one 16-pin IC, one four-position DIP switch and several small capacitors.

3. Notice that one half of the pc board is almost empty. You should see the pattern of four more 24-pin ICs in the empty area.

4. Clean the solder out of all the holes, then solder in four new ICs, Toshiba #TMM2016P or equivalent. Also install the missing 0.1μF capacitors. When installing the ICs, be sure the notch indicating pin 1 is oriented properly—three of them will point to the connector fingers, while the fourth will point to the right.

5. You've now doubled your expansion RAM capability at a very reasonable cost. Reassemble the case and have fun.

Dick Johnson
Norco, CA

VIC Super Expander Tip 1—If you use the Print statement to make sounds while in a hi-res Graphics mode, your graphics will often fly off the top of the screen, never to be seen again. The reason for this is because the screen scrolls after it's full, even though you are not in a Text mode.

There are two ways to avoid this problem. Simply use the Sound command, avoiding the Print statement altogether. Or put a Cursor Up command inside your Print statement, right along with your notes.

Geoff Muehlberger
Atlanta, GA

VIC Super Expander Tip 2—The Super Expander opens a whole new world of programming, but with one major drawback: even though the pixel dots have a range of 0–1023, the pixel-dot format is the usual 160 rows by 160 columns. This can be very confusing, and it makes it impossible to convert Apple and Atari programs to your VIC. You can resolve the difficulty by adding this short line at the beginning of your program.

```
1 QZ = 1023/160
```

Now you can plot the *real* coordinates by adding parentheses and a *QZ after each coordinate to plot. For example, if you want to plot at the real coordinates 35,90, your program would be:

```
1 QZ = 1023/160
10 POINT 1,(35)*QZ,(90)*QZ
```

The parentheses aren't required unless they enclose an expression, but it's a good habit to include them anyway.

Brian Kennedy
Colorado Springs, CO

Super Expander—Super Expanders are not always compatible with the custom characters and other programs for the unexpanded VIC. With the following few Pokes entered before a program is run, you never have to remove or disable the Super Expander. Better yet, make it the first line of every program. For two-part programs, place it in the *second* program:

```
POKE 51,0: POKE 55,0::POKE 52,30:
POKE 56,30: POKE 646,6
```

What's more, none of the extra memory is affected. It's also "harmless" for the unexpanded VIC. (Untested.)

Robert M. Bleich
Graham, WA

VIC Unexpander—Many programs written for the unexpanded VIC will not work properly when used on an expanded machine, since screen locations change with the expansion. Rather than converting the programs (hard work) or removing the cartridge (bothersome), use this trick to make the VIC forget it has extra memory. Just type in:

```
POKE 642,16 : POKE 644,30 : POKE
648,30
```

Hit the run/stop and restore keys to get the cursor back, then enter:

```
SYS PEEK(49152) + 256*PEEK(49153)
```

The procedure also works in Program mode.

Peter Fortini
Piscataway, NJ

UNEXPANDER EXPLAINED—For those of you with a technical interest, here are some explanations of the previous trick. The 8K and 16K memory expansions move the starting positions of screen memory from 7680 to 4096 and the starting positions of color memory from 38400 to 37888. The unexpander routine returns these important positions to where they were, as follows:

- POKE 642,16. Location 641–642 is the pointer to the start of memory, and 641 generally holds 0. Putting 16 in 642 tells the computer that memory starts at 4096 (= 16*256), which is the normal start in an unexpanded machine. (Expansion moves it to 4608.)
- POKE 644,30. Similarly, location 643–644 is the pointer to the top of user memory. In an unexpanded machine, this is at 7680, and the Poke puts it there again (30*256 = 7680).
- POKE 648,30. Location 648 holds the memory page number of the start of screen memory. After the Poke, this memory is located just above the top of user memory.
- SYS xxxxx. This is a restart, or warm boot, which is necessary to emulate the start-up procedure without turning the computer off. Restarting sets things up so the previous Pokes have their desired effect. Some have recommended a SYS64824 as a simpler way of achieving this purpose.

After the Pokes and the SYS call, your VIC has been convinced that its RAM goes from 4096 to 7679, and that its screen starts at 7680. To return the computer to its normal condition, just enter SYS64802; all programs in memory will be lost, but they can be recovered by using an UNNEW program.

Alan Rumsey
Sydney, Australia

VIDEO DISPLAYS

VIDEO TIP—When typing in programs, try turning down the color control on your color TV. The black and white display is easier to read and easier on your eyes.

Michael Crowther
Framingham, MA

TV CONNECTORS—Many TV sets now on the market have 75-ohm F-type connections on the back of the set. Some don't even have the old standard 300-ohm connections! Rather than use the switch box provided with the computer, use an RCA female to F male adapter, available at most electronics stores. (Radio Shack #278-255.)

Not only will your connection at the back of the set be more elegant, but your picture reception may improve (mine did, dramatically), since you've maintained the same impedance and eliminated the switch box, which may add interference to your modulated signal.

Even if you have only 300-ohm connectors, try using an RCA to F adapter with a 75-ohm to 300-ohm matching transformer, also available at most electronics stores. Your picture quality may improve!

Mike Phebus
Lafayette, IN

TV INTERFERENCE TIP—The wavy lines that run through your picture can sometimes be eliminated by unplugging the power cord from your TV and plugging it in the other way (unless the plug is keyed, but in that case you probably wouldn't have the wavy lines).

Ed Badger
Merrimack, NH

VIDEO INTERFERENCE—You can reduce screen interference by coiling the cord that runs from the computer to the TV or monitor. When you get it the way you want it, tie the coil with string or plastic tie wraps. (Changing the cable length also can be of help. Ed.)

Jerome Beck
Glendora, CA

TV TRICKS—Are you still having trouble with the wavy lines on your TV screen? Try disconnecting the TV antenna terminals from the TV/computer switch on the back of your TV. Better yet, do not use the switch at all. Just disconnect the TV antenna and hook the computer directly to the TV's 75-ohm antenna input connector. If your TV does not have a 75-ohm input on it, use a Radio Shack 75–300-ohm transformer (part #15-1140).

Another trick is to install a Drake TV-75-HP high pass filter between the computer and the TV or to install a Drake LF-2 or LF-6 ac line filter on the computer and/or TV.

Walt Grosch
Milwaukee, WI

MONEY-SAVING TVI TIP—I have a Commodore 64, a 1541 disk drive and a Gemini 10X printer with a Cardco interface. I use a standard TV for a monitor and have been plagued with interference. The interference is the greatest when the disk drive or printer is energized.

I intended to buy a 1701 monitor to solve my interference problems when I discovered an antenna interference filter sold by Radio Shack. I installed this filter (part #15-581 or 15-580) between the TV antenna terminals and lead from the TV/computer switch.

The interference was eliminated, and presentation quality now approaches that of a monitor.

Clifford J. Manspeaker
Warner Robins, GA

ULTIMATE TVI CONTROL—For years I had been plagued with the heartbreak of television interference. I tried moving things around, changing plugs, putting foil around the RF modulator and switch—all to no avail. What *was* I to do? Then the idea of sealing my video system with a good coax line hit me, and it works!

My local Radio Shack precut a cable to the length I needed, put the proper connectors on both ends and sold me the necessary adapters to make everything fit together. I took it home and tried it, and presto!—no more lines or noises.

Bill Haines
Warsaw, IN

TEST PATTERNS—Here is a short program that provides an acceptable substitute for a color bar/dot generator. It is written for the C-64 but is easily converted to the VIC-20.

```
10 PRINT CHR$(147);:POKE
   53280,0:POKE 53281,0:FOR I = 1
   TO 24
20 PRINT"{CTRL 9}{CTRL 3}
   {7 spaces}{CTRL 7}{7 spaces}
   {CTRL 8}{7 spaces}{CTRL 6}
   {7 spaces}{CTRL 2}{7 spaces}
   {CTRL 0}";NEXT
30 GOSUB 200
40 FOR I=1 TO 24:PRINT
   "{40 periods}";:NEXT
50 GOSUB 200
60 FOR I=1 TO 24:PRINT
   "{40 SHFT+}";:NEXT
70 GOSUB 200
80 GOTO 10
200 GET A$:IF A$ = "" THEN 200
210 PRINT CHR$(147);:RETURN
```

To change screens, hit any key. For the VIC-20, change line 10 to read:

```
10 PRINT CHR$(147);:
   POKE36879,8:FOR I=1 TO 22
```

Instead of seven spaces in line 20, use four spaces. Change lines 40 and 60 to read 22 instead of 40 in the Print statement.

Terrill S. Barkley
Columbus, NE

COLOR VIDEO SETUP—The colors coming from your computer are very good, but the control settings on your TV or monitor can make a big difference in their appearance. To set your display correctly, follow the procedure below.

- Use the Test Patterns trick to get the vertical color bars on your screen.
- Turn the brightness control all the way up, then turn it down until the background is totally black.
- Adjust the color control until the bars have a good color intensity.
- Use the tint control to set the bars to the correct colors. On the C-64, a more sensitive test can be had by changing the test program so the color bars are purple, orange, brown and light red. (See p. 57 of your user's guide.)
- Go to the crosshatch pattern and set the contrast to a pleasing level.
- Repeat all steps until you have optimized your display.

Gene Casanova
Wauwatosa, WI

COLOR CONVERGENCE TEST—To maximize the definition in a color display, the electron beams coming from the red, blue and green guns must be properly aligned. The adjustments that align the beams are called static and dynamic convergence, and they should be made only by a qualified technician.

To evaluate the convergence of your own color display, you can use the Test Patterns program trick. Put the crosshatch pattern on the screen and turn the color control all the way down. If you see a crosshatch composed of white lines, your convergence is all right. If, however, the lines are not all white, the beams are missing their targets, and your monitor needs its convergence adjusted.

By the way, the crosshatch pattern is also useful for making vertical height and linearity adjustments. These are usually found on back panel controls, and they can adjust the shape of the squares in your crosshatch pattern.

Burt Fisher
Forestdale, MA

ADJUSTING PICTURE SIZE—When Commodore computers are used with certain video monitors, you see the Commodore screen area, surrounded by the Commodore border, surrounded by yet another (black) border. As a result, the usable screen display covers only a fraction of the CRT area, and the characters are much smaller than they might otherwise be. Here are the reasons for the problem, along with a suggested cure.

Displays for TV viewing are adjusted so the outer edges of the picture slightly overlap the edge of the CRT. This is called overscanning, and it's done to gain certain technical benefits; losing part of the picture is the price you pay to gain them. Since losing your screen data to overscan would be unacceptable, Commodore's border keeps the outer screen columns *in*side the edge of the picture.

But monitors made for text displays do *not* overscan. In fact, they *under*scan, to make sure that no character is ever lost. When you put a Commodore signal into such a monitor, you get more borders than you bargained for—Commodore's overscan-protective border, plus the CRT's underscanned outer edges.

Correcting the problem is simple in many cases. Some high-quality monitors are designed for TV *and* data use, with a size switch on the back panel; just set it properly, and the problem will go away.

Most other monitors have a vertical size control on the back panel and a horizontal size control inside the cabinet. Often, these can be adjusted so the useful screen area fills the CRT. Adjusting them is simple and straightforward for anyone qualified in electronics, but dangerous for everyone else.

The vertical size, or height, control is usually a screwdriver-adjustable potentiometer; just turn it until the top and bottom of the black border move outward off the screen.

Usually, horizontal size, or width, is controlled by an iron slug in a coil near the high-voltage flyback transformer; it may or may not be labeled. If it isn't, your monitor's schematic diagram should help you identify it. Unscrewing the slug will usually expand the picture; don't touch it unless you've worked inside a TV before—there are dangerous voltages *very* close by.

On my Taxan monitor, I removed the slug entirely, which brought the Commodore border just to the edge of the screen. Replacing the iron slug with a brass one moved it even farther outward.

If your monitor dealer has a repair department, they should be willing to make both adjustments for you, and to guarantee their work. If you make them yourself, you do so at your own risk, but your actions are unlikely to harm your equipment.

Pat Baker
McKeesport, PA

VIDEO VIDEO—There are times when you might want to connect your computer to two monitors at the same time, to allow simultaneous monitoring in color and black and white, or to monitor a program remotely.

To accomplish this, just insert a phono-plug-to-two-phono-jacks adapter (Radio Shack #42-2436 or #274-303) into the TV connector on your computer or monitor. You'll also need an additional video cable and possibly another computer/TV switch. Note that the video cable is simply an ordinary phono cable, available in various lengths from virtually any music or record store.

David M. Palo
Escanaba, MI

80-COLUMN VIDEO—If you're thinking of buying an 80-column screen expander, be prepared to buy a monochrome monitor as well. Most TVs and color monitors can't display anything more detailed than a 40-column text display, and some of them are hard pressed to do even that. So even if your cartridge puts out perfect 80-column video, your color display probably won't do it justice.

Monochrome monitors generally cost from $100–$175 and are specifically designed to have the resolution that an 80-column display requires. The choice of green, amber or white screen is left to your personal preference. Few monochrome monitors include a speaker, so be careful if you intend to use sound with an 80-column screen display.

Troy Johnson
Milwaukee, WI

TV COLOR FILTER—If looking at a black and white monitor gives you eyestrain, put colored cellophane or plastic wrap over the screen. The kind that is used for gift wrapping or Easter baskets works fine and is very inexpensive. Green, blue or yellow seems to work the best.

Carol Forbey
Flint, MI

VIDEO SHORTCUT—If you have both a VIC-20 and a C-64, along with Commodore's 1701/1702 monitor, and are tired of plugging and unplugging the audio and video cables, try the following hint.

Keep the 64 *and* the VIC plugged in at all times—the 64 into the rear panel set of jacks (with a three-wire cable) and the VIC into the front panel set of jacks (with a two-wire cable). Use the tiny slide switch on the rear panel of the monitor to switch between the two computers.

Karl T. Thurber, Jr.
Millbrook, AL

C-64 VIDEO TIP—Depending on your TV set or monitor, the initial video display of the C-64 can be made sharper by changing the background and cursor colors. Try this:

```
[CTRL 2] POKE 53280,0 : POKE 53281,0
[Return]
```

Long Kha
San Diego, CA

C-64 VIDEO VITALIZER—The display on a conventional TV set can be greatly enhanced by tying a 1000-ohm potentiometer across pins 1 (luminance) and 4 (video out) of the 64's audio/video plug, then adjusting it for best color and resolution. Radio Shack's DIN plug #274-003 and any wire-lead 1000-ohm trim pot help keep this job neat. (Be careful about the pin numbers. In the DIN system, pins 1 and 4 are next to one another. Ed.)

James G. Cooper
New Albany, IN

IMPROVED TV VIDEO ON THE C-64—If you're using a color TV rather than a monitor, you can improve your picture by making up a special plug for the monitor's audio/video connector. (That's *not* the one you plug your TV into.) Referring to appendix I in your user's guide, connect a 150-ohm resistor between the luminance and video-out pins, and the results might amaze you.

Be careful, because the DIN plug's pins aren't numbered as you might expect. The picture in the book shows the solder-lug end of the male connector, and the pins you want are the two on the right.

L.F.S.

VIC SCREEN CENTERING—On some TV sets, the VIC's screen display may not be centered quite right, resulting in a cut-off picture. Location 36864 controls the horizontal center of the screen (normally 5), and location 36865 controls the vertical center of the screen (normally 25). Changing these values can help you to properly center your display.

Westmoreland Commodore Newsletter

VIC VIDEO—On some TV sets with automatic fine tuning, the screen will flutter when the computer is turned on. Try POKE 36864,133 to stop it. In many cases, this will stop the flutter immediately.

Thomas Ulatowski
Caledonia, NY

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IT'S TAX TIME IT'S TAX TIME

RF MODULATOR HINT—Sometimes when the RF modulator is too close to the TV set, it causes interference. Moving it can improve the TV picture, and so can wrapping it with aluminum foil.

Reginald Reed
Orange Park, FL

SOFTWARE

BASIC KEYWORDS

ASC FINDER—This short program makes it easy to find the ASC value for any keyboard character. You can then print the character using PRINT CHR$(x), where x is the ASC value determined here.

```
1 GET A$ : IF A$ = "" THEN 1
2 PRINT A$, ASC(A$) : GOTO 1
```

James M. Byrne
York Harbor, ME

NEW USE FOR CONT—It's not widely known that CONT can be used in Program mode to freeze the computer in an endless loop. You can replace 100 GOTO 100 with 100 CONT, and you won't notice the difference. In either case, the loop will continue until you press the stop key.

Chris Perleberg
Goleta, CA

HANDLING LONG DATA ITEMS—If your data items are long strings, sometimes some of them won't fit on a single program line. For instance, long questions in a quiz program may need three or four lines. To overcome this, find how many lines the longest item will take, and break it into that number of substatements. Then read and print it as several concatenated string variables. Be sure to insert null strings when necessary for shorter Data statements that don't use the extra lines.

Carolyne J. Butler
Address Unknown

DATA STATEMENTS—When entering a zero in a Data statement, you can leave its place blank, and save a little memory and screen space. For example:

```
10 DATA 5,17,0,32
```

would look like

```
10 DATA 5,17,,32
```

When the computer reads the second line, it will put a zero where there is nothing between the commas.

Mathew Stephen
Chadron, NE

STRINGS IN DATA—When entering string data in Data statements, it is unnecessary to enclose the string in quotes unless it contains commas. For example:

```
10 READ A$,B$,C$,D$
. . .
100 DATA "KATHLEEN","MAR
  GARET","TRACEY","BARBARA"
```

could be entered as:

```
100 DATA KATHLEEN,
  MARGARET,TRACEY,BARBARA
```

However, the string CHARLESTON, SOUTH CAROLINA would have to be enclosed in quotes. Otherwise, Basic would interpret it as two separate strings: CHARLESTON and SOUTH CAROLINA. Notice that the space doesn't separate the strings; it is treated the same as any printed character.

Charles Lavin
Coral Gables, FL

FOR. . .NEXT TIP—When using Basic, you must be very careful with the following.

```
10 FOR H = 1 TO 20
20 NEXT H
30 PRINT H
```

The final output, which you might expect to be 20, will be 21. Not only will that value be printed, but every time H is called, until it is changed, the value 21 will be returned.

Russell P. Marsella
Lincoln, RI

FOR. . .NEXT HINT—When breaking out of a For. . .Next loop before it is completed, you should terminate the loop by setting the index variable to its highest value, then branching to a Next statement. Failure to do this can cause problems such as unexpected Out Of Memory errors. Here's a short program demonstrating the technique:

```
100 DIM A(100) : A(50) = 2
110 FOR X = 1 TO 100
120 IF A(X)>0 THEN PRINT X,A(X) :
    X = 100
130 NEXT
140 PRINT "FINISHED"
```

John Belmonte
Chicago, IL

FRE ADVICE—When checking FRE(0) on the Commodore 64, you often get a negative number. (It doesn't mean you have negative available memory; it has to do with the way FRE represents numbers.) To convert the negative value to its proper form, do this:

```
PRINT FRE(0) + 2[up arrow]16
```

Also, there's nothing magic about the zero in FRE(0); you can put *any* letter or number in there. It's usually easier to find FRE(9) on the keyboard, and it gives the same result.

Eric Haver
Pittsburgh, PA

FINDING PROGRAM LENGTH—The FRE function tells how much free memory is in your computer at any moment. If there's a Basic program in your VIC's memory, you can tell its length in bytes by entering:

```
PRINT xxx – FRE(0)
```

where xxx is the Bytes Free value your computer displays when first turned on.

A bug in the C-64 makes FRE return a negative value if there's more than 32K of free memory. The following statement allows for the bug and gives the true length of the Basic program in C-64 memory.

```
PRINT 38911 – (FRE(0) – (FRE(0)<0)*
65536)
```

In both cases, the 0 after the FRE can be changed to any number or letter; its value doesn't affect the result at all.

Ken Lundy
Corona, CA

GET LOOP EXIT—Sometimes you might want to display a screen for a certain length of time by using a For. . .Next loop. But other times you may not want to waste time waiting

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for the loop to end. The following code allows a pre-timed wait to be terminated by a keypress.

```
100 FOR I = 1 TO 500:GET A$:IF
    A$ = ""THEN NEXT
110 Continuation goes here.
```

Stan Tomasevich
Lexington, KY

GET TO INPUT—Here's a way to use the character received with a Get statement as the first character for an Input statement. The technique follows the Then in line 110 below. In the example, if you continually press the space bar, a sequence of numbers is printed. If you input a number in place of the space, that number is printed instead. The example is useless, but the technique has lots of possibilities.

```
100 GET A$ : IF A$ = "" THEN 100
110 IF A$< >"[space]" THEN POKE
    631,ASC(A$) : POKE 198,1 : INPUT B
120 PRINT B : B = B + 1 : GOTO 100
```

Ron Ahern
San Diego, CA

MULTIPLE-CHOICE GET—The following short routine lets you detect keypresses, from a specified group of keys, and directs the program according to the detected keypress.

```
10 GET A$ : J = 1 : FOR I = 1 TO 4 : IF
   A$ = MID$("ABCD",I,1) THEN
   J = I + 1
20 NEXT : ON J GOTO 10,aaa,
   bbb,ccc,ddd
```

In the example, aaa, bbb, ccc, ddd are the statement numbers you want the program to go to if A, B, C or D is pressed. The string in the MID$ expression can be as long as you'd like, and can even include function key codes. Try it!

Jason Dorn
Saratoga Springs, NY

USING GET INSTEAD OF INPUT—Here's a way to get rid of the question mark while getting input from the keyboard.

```
5 B$ = ""
10 POKE 207,0 : POKE 204,0 : GET A$
   : IF A$ = "" THEN 10
20 IF A$ = CHR$(13) THEN PRINT
   CHR$(32) : GOTO 40
30 PRINT A$; : B$ = B$ + A$ : GOTO 10
40 REM THE INPUT IS STORED AS B$
```

It's necessary to print CHR$(32), which is a space, to obliterate the cursor in case it is on when you press the return key.

N.S. Hanspal
King of Prussia, PA

USING THE GET STATEMENT—A good programmer will write this:

```
10 PRINT "PRESS ANY KEY TO
CONTINUE"
20 GET A$ : IF A$ = "" THEN 20
```

A better programmer will empty the keyboard buffer first, so that any previous keystrokes are ignored:

```
10 PRINT "PRESS ANY KEY TO
CONTINUE"
15 GET A$ : IF A$< >"" THEN 15
20 GET A$ : IF A$ = "" THEN 20
```

An alternate way to empty the buffer is:

```
15 POKE 198,0
```

John R. Olsen, Jr.
Newberg, OR

GET ERRORS—Here's a Get routine that avoids a possible Type Mismatch crash when using numerical values:

```
10 PRINT "CHOOSE A NUMBER 1-5";
20 GET A$ : IF A$ = "" THEN 20
30 A = VAL(A$) : IF A<1 OR A>5
   THEN 20
40 PRINT A
```

Line 20 inputs the data as a string value to avoid the Type Mismatch crash if an alphabetic key is pressed. Line 30 converts the data to numeric form and checks whether it's in the right range (1 to 5 in the example). The routine won't crash, accepts only the numbers you specify, and it does not require you to press the return key.

John Blanford
Ventura, CA

CURSOR FOR GET—A disadvantage of the Get statement is that it provides no flashing cursor to prompt the user for input. Here's a way to provide a cursor:

```
10 POKE 204,0
20 GET A$ : POKE 207,0 : IF A$ = ""
   THEN 20
30 POKE 204,1 : PRINT A$
```

The Poke statements in lines 10 and 20 tell the computer to turn on the cursor while it is waiting for a key to be pressed. Line 30 turns off the cursor and prints the value of A$. Be sure to print something at this step, even if it's just a space, or an image of the cursor might be left on the screen.

David Palmer
Address Unknown

GOTO NOTHING—If you're using a GOTO statement in a place where every byte counts (such as in a one-liner), start with line 0 and use GOTO without a line number. It saves a character and still returns to line 0.

Heath Fallin
Baconton, GA

IF TIP—The mathematical expression between If and Then determines whether the rest of an If statement will be executed. When the expression is false, the rest of the line is skipped.

You can use this feature to save execution time. Rather than using a statement like 100 IF X = 1 AND Y = 2 THEN PRINT Z, it is much faster to write 100 IF X = 1 THEN IF Y = 2 THEN PRINT Z.

In the first case, X = 1 AND Y = 2 must be evaluated before any line skip decision is made. In the second, as soon as X = 1 is evaluated as false, everything else is skipped. The result is faster execution whenever X = 1 is false.

Bob McKinley
Greensburg, PA

IF. . .THEN. . .ELSE—Unfortunately, Commodore Basic doesn't have this useful construction, which allows you to redirect the program if the If statement fails. You can use the ON. . .GOTO statement to give a similar effect, as in this example:

```
400 GET A$ : IF A$ = "" THEN 400
500 ON((A$ = "Y") + 2) GOTO 600 : ON
    ((A$ = "N") + 2) GOTO 700 : GOTO
    400
600 PRINT "YES" : END
700 PRINT "NO" : END
```

Note how the two tests have been put on the same program line.

Mike Sokolewicz
San Francisco, CA

INPUT MAGIC—If you don't want the question mark with an Input statement, try entering

POKE 19,64 before it. This disables the question mark. To recover, enter POKE 19,0.

With this technique, you can't just press the return key where an input is required—the cursor will not move until you actually input something. Also, the cursor does *not* automatically move to the next line following your press of the return key; if you want it down there, just execute a Print statement following the input.

Bart van Baren
Wageningen, Netherlands

INPUT IMPROVED—One drawback of the Input statement is that it prompts the user with a question mark even if the instruction is not a question. You can avoid this by using the Input# statement and having the computer treat the keyboard as a peripheral. Here's an example:

```
10 PRINT "TYPE YOUR NAME";
20 OPEN1,0:INPUT#1,NM$:PRINT:
CLOSE1
30 PRINT NM$
```

With this method, the computer doesn't print a carriage return after the inputted data, so you must add PRINT after INPUT#, as is done in the example. If your program does a lot of inputting, you could set up the material in line 20 as a subroutine to be called each time you need it.

Randy Palermo
Fort Jones, CA

INPUT HINT 1—If you use Input statements, you should know that the computer reads everything to the right of the question mark. So if you have graphics or text to the right of an Input statement on the same line, the computer will read it along with your data, most likely causing an error.

The solution is to make sure the screen is blank to the right of your Input prompt.

Michael Berry
Kewanee, IL

INPUT HINT 2—Quotation marks can help you input strings you didn't think were possible to input. By typing quotes before and after your input, you can add leading and trailing blanks that would normally be truncated. You can also input commas (no more Extra Ignored!), colons, cursor controls and so on. To input a delete character any time after your initial quote, just type "[CRSR LF][insert][delete]." The best part is that the quote marks will not be included in the string (for example, "MAGIC" has five characters in the string, not seven).

Richard Shine
Carrollton, TX

MORE ON INPUT STATEMENTS WITH QUOTES—You can use the dynamic keyboard technique to put leading quotation marks on your response to the Input statement. For example:

```
100 PRINT "WHAT MAGIC CHARMS";
110 POKE 631,34 : POKE 198,1
120 INPUT C$
```

34 is ASCII for the quotation mark, and the Pokes make the computer think you've typed it. Now the computer will accept any key except the return and delete keys.

Errol Lisonbee
Salt Lake City, UT

INPUT PROMPTS—When using the Input statement, don't use prompts longer than 38 characters (on the C-64) or 20 characters (on the VIC). Due to a bug in the ROM (Read Only Memory), longer prompts will result in bad reads or an error message. Reports say the bug has been fixed in the SX-64 portable computer.

Michael L. Bumbaugh
Lima, OH

INTERESTING INPUT PROMPT—To get an unusual flashing prompt, try this:

```
10 INPUT"[2 spaces][COMD B]
   [3 CRSR LF]";A$
```

For variety, try substituting different graphics for the COMD B. To ensure you don't get the graphics symbol itself, as A$, you can add this to the end of line 10:

```
:ON (A$ = "[COMD B]") + 2 GOTO 10,20
```

Then put your program continuation at line 20.

Brooks Hunt
Alexandria, VA

ANOTHER QUERYLESS INPUT—There's another method of eliminating the question mark when getting input from the keyboard. The secret is the little-known fact that the keyboard has a device number of 0, and that any piece of hardware with a device number can have an input channel opened to it. To see what this means, try the short program below.

```
10 OPEN 1,0
20 PRINT "TYPE SOMETHING";
30 INPUT#1,A$
40 PRINT
50 CLOSE 1
60 PRINT "YOU TYPED:"A$
```

Line 10 opens an input channel to the keyboard. Line 30 gets the user's input. Line 40 is necessary to move the cursor to the next line and line 50 closes the channel. You get no question mark with this method, but you must carefully control the cursor position.

Michael Scharland
Steger, IL

UNIVERSAL INPUTS—The ominous appearance of ?REDO FROM START can be unsettling to the user who doesn't realize that the computer merely wants numeric rather than string input (or vice versa). The following routine allows a program to accept inputs in either form, displaying them in a chosen format. The technique permits flexibility in data entry, while ensuring that the output is standardized.

```
100 INPUT "MONTH";M$
110 FOR M = 1 TO 13 : READ MO$
120 IF LEFT$(M$,3) = MO$ THEN 150
130 IF VAL(M$) = M THEN 150
140 NEXT
150 PRINT MO$
160 PRINT:RESTORE : GOTO100
170 DATA JAN,FEB,MAR,APR,MAY,
    JUN,JUL,AUG,SEP,OCT,NOV,
    DEC,???
```

In my example, months can be entered in numeric or alphabetic form and abbreviated or spelled in full, and the program returns their three-letter abbreviations. Simple changes will make the program return the numeric form of the month, or even its fully spelled name. Of course, the technique isn't limited to months of the year, but can be used in a wide variety of situations.

Eddie Johnson
Albuquerque, NM

INT HINT—Some Basic statements and functions automatically perform an INT as an early step in their processing, and in those cases an INT in your program may be unnecessary. Poke is one of these, and one where we often see the unnecessary use of INT. You can prove it to yourself by running this little program:

```
100 POKE 5000,INT(99.5)
110 PRINT PEEK(5000)
120 POKE 5001,99.5
130 PRINT PEEK(5001)
```

As you can see, both Peeks are 99. As you learn more about Basic, you'll see more and more places where you can eliminate INT.

A.W. Grym
London, England

INTFORMATION—The INT Hint trick informs us that some statements and functions automatically perform an INT function before further processing. Truncating to an integer is automatic in at least the following cases, and possibly others.

Array Subscripts
CHR$
DIM
GOSUB
GOTO
LEFT$
MID$
PEEK
POKE
RIGHT$
SPC
TAB

Ian Adams
Vancouver, British Columbia

LIST DISABLE—At times you may write a program that you don't want listed by other people. Perhaps you are a teacher and don't want your programs listed by students. There is a magic REM statement that does this.

On the first line that you don't want listed, put REM [shifted L]. When it tries to list the shifted L, the computer will display ?SYNTAX ERROR and return to the Ready mode. The person might then try to erase the line. To prevent this, put other important statements on the same line before the REM. For example:

```
10 A = 7768:B = 2:REM[shifted L]
```

If the person erases the line, the program will not work properly.

Rick Wyman
Hampden, MA

LIST MAGIC—If you execute the List command from within a program, the listing will take place, but program execution will stop. You can use the following routine to Poke the word RUN into the keyboard buffer, and to execute the run as soon as the list is finished.

```
10  FOR I = 631 TO 634 : READ A :
    POKE I,A : NEXT : POKE 198,4
20  DATA 82, 85, 78, 13
30  LIST
```

Craig Lewis
Address Unknown

GOOD LISTING FROM BAD LINES—Did you ever get a Syntax error without finding an error in the indicated line? Not all keyboard entries show up when you list your program, and the secret to debugging success may be to reenter the suspected line. For example, enter the following program, purposely misspelling PRINT by inserting a shifted Q between the I and the N:

```
100  PRI[shift Q]NT “DOUG HENNING”
```

When you try to run the program, you'll get a Syntax error. List the program to find the error, and you won't be able to see it. Surprised? The shifted Q didn't show up at all! To fix this problem, retype your line. To fix it with less effort, move your cursor up to the listed line, then press the return key.

L.A. Gerig
Monroeville, IN

C-64 SLOW LISTER—You can slow the listing on a C-64 by entering:

```
POKE 56324,28 : POKE 56325,0
```

When you ask for a listing, the computer may seem to stall for a moment, but give it time and it'll start a very slow list. To make things even slower, press the CTRL key or Poke a lower number into 56324. To return the computer to its normal mode, press the stop and restore keys simultaneously.

Thomas J. Tennant
Louisville, KY

LOADING FROM WITHIN A PROGRAM—It's often desirable to split programs into two parts, usually to save space in memory. You can load program #2 by executing the Load command from within program #1, but you must take some precautions. When one program loads another, the second program *must* be shorter than the first. (You can use the FRE function to compare the programs' lengths.) Some side effects of this process are that the second program is executed automatically after it's loaded, and any variables used in program #1 retain their values when program #2 is executed.

If you're loading from tape, you can get around the program length restriction and avoid both side effects by putting the following line at the start of program #2.

```
0 POKE 45,PEEK(174) : POKE
  46,PEEK(175) : CLR
```

If you modify a program to which this line has been added, you *must* remove the line before executing the modified program. Failing to do that will cause an unrecoverable disaster.

Anne Phillips
New Denver, B.C.
Canada

DYNAMIC KEYBOARD LOADS—When loading one program from another, you can avoid the length restrictions and side effects of Program mode loads by using this:

```
5000  PRINT “LOADING [3 CRSR DNs]”
5010  PRINT “LOAD”CHR$(34)
  “programname”CHR$(34)“,8
  [3 CRSR UPs]”
5020  POKE 631,13 : POKE 632,82 :
  POKE 633,85 : POKE 634,78 : POKE
  635,13 : POKE 198,5 : END
```

When executed, this will act as if you typed the Load command on the keyboard and then typed RUN when it was complete. If you use tape rather than disk, replace the 8 in line 5010 with a 1.

P.R.D.
Hales Corners, WI

EASIEST PROGRAM MODE LOAD—If you are using a Datassette, the easiest way to load and run one program from another is this:

```
100 POKE 631,131 : POKE 198,1
```

It has the same effect as pressing the shifted run/stop key.

Craig Lewis
Address Unknown

EASY LOAD AND SAVE—If you're copying a program from one disk to another, you first load it by entering LOAD"programname",8. When the time comes to save it again, just type SAVE over the former LOAD, then hit the return key. It saves your having to retype the program name and drive number. To save even more, use L [shift O] as an abbreviation for the Load command, and S [shift A] as an abbreviation for the Save command.

Walter Dickerson
Brick, NJ

THE ON STATEMENT—This simple little statement can be used to make multiple-choice branching decisions. How often have you seen a program that suffers from a long list of conditional branches, such as:

```
10  GET A$:IFA$ = "" THEN GOTO 10
20  IF A$ = "A" THEN GOTO 1000
40  IF A$ = "B" THEN GOTO 1100
50  Etc, etc, etc.
```

All of this can be greatly simplified by using one appropriate test:

```
10  GET A$:IFA$ = "" THEN GOTO 10
20  ON ASC( A$ ) - 64 GOTO 1000, 1100,
     1150, etc., etc.: GOTO 10
```

If A$ is not one of the letters specified, then the first GOTO command will be ignored.

There are many other ways to use the On statement. The only restrictions are that the expression being tested cannot be a negative number, nor a positive number greater than 255. Either of these conditions will generate an error message.

Ian Adams
Vancouver, British Columbia

ON . . . GOSUB TRICK—If you are using ON . . . GOSUB or ON . . . GOTO and the number of destinations cannot be fitted onto one program line, break the On statement into two lines:

```
100 ON P GOSUB 1000,2000,3000
     5000,6000,etc. to 12000
110 IF P>12 THEN Q=P-12
120 ON Q GOSUB 13000,14000,15000,
     16000,etc.
```

D.R. Cool
Huber Heights, OH

ON X GOTO TIP—There's a bug in the documentation for this statement. If X is negative or greater than 255, the program will *not* fall through to the next line. You will get an Illegal Quantity error.

Westmoreland Commodore Newsletter

ON . . . GOTO APPLICATION—There are many times when a Basic program needs to "hold" on a line waiting for user input of some type. A common way to do this is:

```
10 GET A$: IF A$ = "" THEN 10
```

The trouble with this is that it "wastes" a whole program line. Here is another way:

```
10 GET A$: ON -(A$ = "")GOTO 10
```

As long as A$ = "", i.e., no input, the line is executed over and over. As soon as a key is pressed, the ON . . . GOTO becomes invalid and execution will continue on the same line. So you could have something such as:

```
10 GET A$: ON -(A$ = "") GOTO 10:
   A = INT(X/256): B = X - 256*
   A: etc. . .
```

This allows you to pack more on a line.

Doug Smoak
Columbia, SC

QUOTATION MARKS—When using the Print statement with material enclosed in quotes, it is often acceptable to eliminate the second quotation mark. For example, the computer will treat these two statements just the same:

```
100 PRINT "MAGIC IS FUN"
110 PRINT "MAGIC IS FUN
```

Eliminating the second quotation mark saves a byte of memory, a keystroke and a space on the screen line, which are all important from time to time. But be careful—the last letter of the material in quotes *must* be the last thing in the program line. Because of the GOTO in this statement, the second quote, 120 PRINT "ABRACADABRA": GOTO 120, must be retained.

Because of the semicolon after this Print statement, you also need the closing quote: 130 PRINT "LEGERDEMAIN";

L.F.S.

SEMICOLONS—It is often acceptable to eliminate the semicolons between several items that are to be printed on the same line. As long as there is no ambiguity about where one item ends and the next begins, the semicolons are unnecessary. In this example:

```
140 PRINT A$;B$;C$;D;"E"
```

the dollar signs and quote marks make it absolutely clear which item is which.

The line can easily be shortened to:

```
140 PRINT A$B$C$D"E"
```

The semicolon *must* be included in this line:

```
150 PRINT F;G
```

If it were removed, the computer would print the value of variable FG, which is not what is wanted.

L.F.S.

COMMAS—Putting a comma between two items in a Print statement causes the second item to be printed at the next preset "tab stop" on the screen. On the Commodore 64, there are four tab stops per screen line, while on the VIC-20, there are only two. Additional commas between the items cause additional tab stops to be skipped. If you want A and B to be printed at tab stops 1 and 4, here's a tricky way to do it:

```
100 PRINT A,,B
```

L.F.S.

PRINTING QUOTES—The trick for putting quotation marks around a word is simple once you look at it:

```
10 PRINT CHR$(34)
   "BARTLETT" CHR$(34)
```

John Ouverson
Madison, SD

SHIFTED REMS—Trying to put graphics or shifted letters into

REM statements can be frustrating—they list in strange ways, usually as Basic keywords. To get them to behave, put them inside quotes.

The Transactor

REM TRICK—(This is a really good one!) You can make your listings do very unusual things by incorporating color changes, RVS on, cursor movements and so on into REM statements.

Enter your remark, including the control characters and any text, as if it were a character string in a Print statement, but leave off the closing quote. Then press the return key and use the cursor keys to position the cursor over the first character in the string. Insert a shifted return character by pressing

```
[RVS on][insert][shift M][Return]
```

The shifted return will appear as a reversed shifted M or reversed backslash. Now, when the line is listed, all the control characters after the shifted M will be executed, just as though they were in a Print statement!

You can't edit this special REM from a listing, so to test it, list it by itself while the original line you typed is on the screen. Try the following to see what we mean.

```
10 REM"[wht][RVS on]WHITE MAGIC!
```

Type it in, then insert the shifted return as described above. List 10, then try some of your own.

Carl Onsgard
Green Bay, WI

HIGHLIGHTING REMS—Many people use asterisk-filled REM lines before and after their program remarks to make the remarks stand out in program listings. Typing all those asterisks can be tedious, but there's a simpler way. Simply type REM" and hold your finger on one of the cursor keys.

The quote mark after the REM puts Quote mode graphics symbols on the screen in place of cursor movements, and the repeating feature of the cursor keys eliminates having to type each character individually. All you do is remove your finger before the end of the line is reached. Incidentally, if you indent your remarks, let the repeat feature of the space bar indent, too.

Glenn Zuch
N. Tonawanda, NY

REMLESS REMARKS—As soon as the Basic interpreter encounters a REM statement, it skips to the following line. Here,

```
10 X = 1 : REM MOVE MISSILE :
   GOTO 100
```

the GOTO will never be executed, since it follows a REM statement.

However, there are many cases where you can omit the REM statement! As long as the Basic interpreter does not try to execute your comments, you are safe. If line 50000 is never executed, you may say:

```
50000 SET X = 1 TO MOVE THE
   MISSILE
```

You can also get away with:

```
10 X = 1 : GOTO 100 : MOVE MISSILE
```

Westmoreland Commodore Newsletter

REMARKABLE IDEA—As your program collection grows, it becomes impossible to remember where you got each program. This, of course, can be frustrating when you must know who wrote a program or when you must look up the magazine article that contains the documentation. A simple solution is habitually to include source information in a low-numbered REM statement. For example:

```
0 REM ** RUN, AUGUST 84, PAGE 10 **
```

Charles L. Moore
Fairfield, AL

USES FOR REMS—REM statements are helpful for more than describing a subroutine or naming the programmer. I use them at the beginning of each program to list the source and location of the program, plus any special instructions that may be required in using it. For example:

```
10  REM FILE HANDLER—RUN FEB 84
    PAGE 48
20  REM USE SPACE BAR TO SKIM
    PAGES. USE RETURN TO SKIM
    CATALOG.
```

Howard VanDover
Trenton, MI

REVEALING REMS—You can make your REM statements stand out from the rest of your listing by preceding and following them with lines composed of a line number and a colon. Here's an example:

```
4970 PRINT "KATHLEEN"
4980 :
4990 REM TAX ACCOUNTING
     SECTION
5000 :
5010 INPUT "TAXABLE AMOUNT";
     TA"
5020 INPUT "CATEGORY";CA
```

Lines 4980 and 5000 use a few bytes of memory and take a few microseconds to execute, but they make the REM line much easier to spot in a listing.

Frank Colosimo
Rochester, NY

RND HINT—Many programs call for something like X = INT(N*RND(0)) + M. You can save time and keystrokes by using X% = N*RND(.) + M. The use of the integer variable form saves an INT, and the use of the period in the argument saves execution time.

S.A. Bennice
Roanoke, VA

RANDOM NUMBERS—Type in the following program and run it a few times. Each time you run the program, write down the numbers. Now turn off your computer and do it again. You might be surprised by the results, which show an identical sequence of numbers each time.

```
10  FOR A = 1 TO 6 :
    B = INT(RND(1)*100) :
    PRINT B : NEXT
```

Change the RND(1) to RND(0), then repeat all your steps. You'll see that a zero value in RND's argument makes for a lot more randomness. Positive values should be used as arguments for RND only when you want the series of numbers to repeat, as in testing a program.

Ian Lauder
Kalispell, MT

C-64 SAVE DISABLE—You can disable the C-64's Save command with POKE 818,32. To enable it again, enter POKE 818,237.

Damien Nelson
Melbourne, Australia

MULTIPLE SAVES—You can make multiple copies of a program by putting the Save command in a For. . .Next loop, such as:

```
FOR I = 1 TO 3 : SAVE "HARRY
ALBACKER" : NEXT
```

You can even number each copy:

```
FOR I = 1 TO 4 : SAVE "THE GREAT
CARSONI" + STR$(I) : NEXT
```

David C. O'Sada
Jacksonville, FL

STOP AND CONT—These two commands can be used as valuable debugging tools. CONT will restart a program that has been halted by the stop key, or by an End or Stop statement. Execution will continue from the statement following whatever caused the halt.

You can put STOP into your program at various test points. When the program encounters a Stop command, the number of the last line executed will be shown on the screen, proving that the program reached the line in question. While the program is halted, you can check the value of variables, and can even change them if you'd like. A Direct mode CONT will, of course, resume program execution.

Charles Brogdon
Dalton, GA

STR$ TIP—If you want leading zeroes to appear in the strings produced by STR$, use:

```
X$ = RIGHT$(STR$(100 + N),2)
```

This will give 01 instead of 1, 02 instead of 2, and so on, but will not add the zeroes to numbers from 10–99. You can use a similar method to add leading zeroes to numbers of as many digits as you want.

W.E. More
Le Sueur, MN

SYS TIP—You don't need to put parentheses around the number after a SYS statement. SYS828, SYS 828 and SYS(828) all mean the same thing to your computer.

L.F.S.

MULTIPLE VERIFY—The Verify command works nicely in a For. . .Next loop, too. If the verification fails, the loop will abort with an error message.

James M. Byrne
York Harbor, ME

DEBUGGING TIPS

DEBUGGING LONG LINES—If you're getting a Syntax error from a multi-statement line, but you can't find your error, put a dummy Print statement after each statement on the line. If the Print statement works, you know that the error must lie after it. Once you've found the error, you can remove the dummy Print statements.

A. Lubin
Monsey, NY

EASIER DEBUGGING—When debugging, you often need to return repeatedly to certain sections of the program. To get there much faster, you can insert lines like the following at the beginning of your program.

```
0  GOTO20
1  LIST 100-200
2  LIST 450-550
3  OPEN 3,4:CMD3:LIST 400-430
4  etc.
20  REM END OF DEBUG
```

The line numbers to list are only examples; you'll want to use whatever line numbers are most appropriate for the program being debugged. To use the routine, just type in RUN 1 to list lines 100–200, RUN 2 to list lines 450–550, RUN 3 to list to the printer and so on. Since executing the List command terminates program execution, you don't have to put End or Stop commands in each line. An alternate routine is this:

```
0  GET A$:IF A = ""THEN0
1  IFA$ = "A"THEN LIST 100-200
2  IFA$ = "B"THEN LIST 450-550
3  IFA$ = "C"THEN
   OPEN3,4:CMD3:LIST 400-430
20  REM END OF DEBUG
```

Here, you just run the program, then press a key for the listing you want. Typing an unused letter will execute the program normally. I've used both forms of this trick with great success.

Mike Rogalski
Monrovia, CA

OUT-OF-MEMORY-ERROR FIX—After you've spent hours at your VIC, nothing can be more discouraging than getting an Out of Memory error when you try to save your program. Try to save it with a shorter name or with no name at all, and you'll often be successful. This trick has saved my sanity a couple of times.

James F. Walker
Gladwin, MI

TEMPORARY LINE CHANGES—Sometimes you may want to change one line of a program, with a good chance of later changing it back again. You can save time by listing the line in question, then overwriting its line number with a number XXXX, outside the range of the program. Hit the return key, and the line will be duplicated with number XXXX. Now make your changes in the original line. If they're all right, just delete line XXXX. If they're *not*, list line XXXX and change its number back to the original, then delete XXXX.

Phillip Sellati
Lima, OH

TEMPORARY LINE DELETES—If you want to see the effect of removing a certain line from your program, use the insert key to open space after the line number, then type in REM. When you hit the return key, the line will be changed to a remark. If the change pleases you, just delete the line. If it doesn't, just delete the REM statement, press return again, and you'll be right back where you started.

Nolan Orkin
Hemiptera Lake, FL

SAVE THE GOOD PART—If you're having trouble with a particular part of a new program, put a mini-program on tape, containing only the essential parts of the main program.

Once it works in the short form, you can transfer it to the finished product.

Bob McClain
Hemphill, TX

CURSOR COLOR ASSIST—When proofreading difficult parts of a program, such as Data statements with a lot of similar numbers, list the lines, then press [CTRL 1]. This gives you a black cursor that you can position over the characters you're proofreading. It highlights each character without covering it up, and it's surprising how the errors stand out. Using this method, I often find small mistakes that I would otherwise have skimmed over, such as a wrong number or the use of a period in place of a comma.

Paula Meyer
Fond du Lac, WI

LOWERCASE ASSIST—When searching for the cause of a Syntax error, press the Commodore and shift keys to change the screen display to lowercase. This makes numbers and letters easy to distinguish, and you can spot a zero from an O, a one from an L or an omitted number quite easily.

Marion Maddocks
Glenwood, IA

HIDDEN KEYWORDS 1—When "crunching" programs, it is possible to put together a keyword and a variable name that will form another, unwanted, keyword. If this occurs, you will get a syntax error. In order to avoid this, you need only put a space between the letters forming the unwanted keyword. For example: IFC = FORC = BTHEN 100 should be IFC = F ORC = BTHEN100, and FORI = STOP should be FORN = S TO P.

Mark Dancheck
Whitehall, PA

HIDDEN KEYWORDS 2—Sometimes you'll get a Syntax error message for a line that appears to have correct syntax. If the problem eludes debugging, look for a Basic reserved word such as TAB or IF used in a variable name. The user's manual contains a warning on this, along with a list of reserved words in Appendix D. The reserved words most likely to be involved are the two-letter ones: FN, IF, ON, ST, TI and TO.

Paul Gough
Wallingford, CT

DATA DEBUGGING 1—When you get an ?ILLEGAL QUANTITY ERROR in Data statements, just put a temporary Print statement between the Read and Poke statements, like this:

```
10 READ A: PRINT A: POKE I,A
```

When the program hits the illegal quantity, you know that the last value printed is the bad one. Then you can easily locate the problem and repair it, without searching through all the Data statements.

Roy McMahon
Imperial, PA

DATA DEBUGGING 2—If you have a program that contains a lot of Data statements and you are reading from these and Poking to other locations, neglecting a comma can mean an Illegal Quantity error. Instead of searching through these statements to find the incorrect one, you may use the data line number locations to locate the bad line. Simply type:

```
PRINT PEEK(64)*256 + PEEK(63)
```

The computer will respond with the line number of the illegal Data statement. This is much easier than searching through all the data.

Andy Bonham
Kingston, Ontario
Canada

DATA STATEMENT DEBUGGER—I use this on those occasions when I suspect my Read statements are out of step with their intended Data statements:

```
50 READ A : PRINT A, PEEK(63) +
   256*PEEK(64)
```

It prints both the data item and the number of the line it was read from. Just insert the Print statement after the appropriate Read statement in your program, and delete it after debugging is complete. Of course, you must make the variable in the Print statement the same as that in your Read statement.

Ben Cherry
Elmira, MI

STRING TOO LONG ERROR—Commodore Basic string variables can accommodate up to 255 characters, but attempting to transfer long strings from tape or disk can cause problems. The Input# statement can only handle 80 characters, including the carriage return delimiter, and attempting to have it handle anything longer will give a String Too Long error. The solution to the problem is to break long strings into segments of 79 characters or fewer before writing them to disk or tape. Then read the segments one by one and recombine them inside the computer.

Chuck McGaffin
Ballston Lake, NY

C-64 LOCKUP BUG—The C-64 has an editing bug that causes you to lose control of the keyboard at certain times. The bug crops up when you exceed two screen lines while entering text at the bottom of the screen. If you attempt to delete back to the second line, horrible things happen, and they are hard but not impossible to correct.

First your keyboard locks up. Then, if there's a program in memory, the computer attempts to run it. If it ends up on an Input statement, you're in big trouble, since you can make no input. If there is no program in memory, the computer may attempt to load one from tape.

Many solutions to this bug have been advanced, but they don't seem to work consistently. Here are some that we've tried:

- Use one of the following cursor colors when typing, and the bug won't occur: black, white, purple, green, orange, brown, gray 2 or light green.
- Press the shift and 3 keys, which might get a Press Play on Tape message. If it does, press your recorder's play key, then hit the run/stop key.
- Plug a joystick into port 1 and work it actively, pressing and releasing the fire button all the while. This might also get the Press Play message.

- Use your reset button, then use an Un-New program to resurrect whatever you had in memory.

Robert L. Lykins
Anchorage, AK

VARIABLES DUMP—When your program stops due to an error, or when it runs but gives unexpected results, it's often useful to examine the values of the variables in the program. You can easily look at them from Direct mode, just by entering PRINT A to look at A, PRINTX$ to look at X$ and so on.

You can even look at arrays by typing in a simple Direct mode For...Next loop. But be careful—certain actions will reset all your variables to null. The most common of these are CLR, Run, or making additions, deletions or changes to numbered lines. As long as you avoid taking these actions before looking at the variables, this technique can save you many hours of frustration.

James P. Koermer
Papillion, NE

MACHINE LANGUAGE

MAKING ML BOOTS—When you want to easily load and execute a machine language program, a small Basic program called a boot can be very helpful. There's a little trick to bootmaking; its necessity is illustrated in the following program, which will never get to line 20.

```
10 LOAD "WAND",8,1
20 SYS49152
```

Line 20 will never be executed because the Program mode Load command causes a program to be loaded, then immediately starts executing whatever Basic program is in memory, retaining the values of all variables from the previous run.

So line 10 will load WAND, then the computer will execute line 10, which will again load WAND and so on, *ad infinitum*. The following program *will* run properly, since it includes a test to see whether the Load command has been executed.

```
10 IF TEST = 0 THEN TEST = 1:
   LOAD"WAND",8,1
20 SYS49152
```

When you type RUN, all variables, including TEST, will be set to zero. The If. . .Then will succeed, TEST will be set to 1, and WAND will be loaded. When line 10 is executed again, the If. . .Then will fail, so control will transfer to line 20 and the SYS will be performed.

Errol Lisonbee
Salt Lake City, UT

LOADING MACHINE LANGUAGE—When you want to load some machine language while a Basic program is in memory, you're faced with a dilemma. Since loading the ML disrupts some internal pointers, you have to use the New command, which removes your Basic from memory, after the program has loaded.

You can avoid the problem by temporarily adding the following two lines to your Basic program.

```
0 END
1 LOAD "programname",8,1
```

Programname, of course, is the name of the ML program you want to load. To load it, just enter RUN 1. Since your program is now being loaded from Program mode, there's no need to use the New command. (Program mode loads don't disrupt the pointers.) Line 0 will prevent your Basic program from being executed again after it's loaded.

If you want to load ML from a Basic program and have the Basic continue after the ML loads, use:

```
0 IF F = 0 THEN F = 1 : LOAD
"programname",8,1
```

The first time you run the program, F has the value 0 and the file will be loaded. Once it's loaded, the program will start running all over again, but with the values of all variables intact. Since F = 1 at this point, line 0 will be skipped and the rest of the program will run as usual.

Barry G. Adams
Fredericton, New Brunswick
Canada

ML MONITOR HARD COPY—The following simple line will cause a machine language monitor's output, prompts and all, to be printed on your printer.

```
OPEN 4,4 : CMD4 : SYS xxxx :
PRINT#4 : CLOSE4
```

The xxxx refers to whatever SYS number activates your monitor. When you press the return key, screen output will be directed to the printer instead.

I've used this with Hesmon, Minimon, Micromon, Monitor $0C00, Monitor $8000 and Supermon64.V1, all with excellent results. With Supermon, and perhaps with others, you must first run the monitor, exit back to Basic with the X command, then use the command line above.

Dale Sowell
Senatobia, MS

SAVING MACHINE LANGUAGE—You do not need a monitor program to save a machine language program or block of data stored in RAM. First determine the starting and ending addresses of the memory block you wish to save, then add 1 to the ending address. Poke the low and high bytes of the starting address (HI = INT (ADDRESS/256); LO = ADDRESS – 256*HI) into memory locations 43 and 44.

Next, Poke the low and high bytes of the end address into memory locations 45 and 46, respectively. Finally, save the block with the usual Basic command: SAVE"programname",8. When the Save is finished, you must reset your computer, since your Pokes have hopelessly upset some important Basic pointers.

J. Winnie
Kila, MT

STACK POINTER—To determine the stack pointer's position from Basic, enter:

```
POKE 2,96 : SYS 2 : SP = PEEK(783)
```

The Poke command puts an RTS where you can get at it, SYS 2 executes the RTS and 783 will then hold the stack pointer. The variable SP will hold it, too.

Eric Haver
Squirrel Hill, PA

HELP FOR SYSsIES—Many people think the Kernal routines are mysterious entities, usable only by highly experienced machine language programmers. This isn't always true, and some of the routines are easily used from Basic. The *Commodore 64 Programmer's Reference Guide* describes all the Kernal routines, along with their memory locations. The one I use most often is CLALL, located at 65511, which closes all open files.

To access a Kernal routine, you need to know its memory address, then:

```
SYS[address]
```

Samuel K. Clay
Dixie, WA

MAGAZINES & BOOKS

MAGAZINE CORRECTIONS—Every computer magazine has a section similar to RUN AMOK, where errors in previous issues are corrected. When I get a new copy of a magazine, I turn to that column, then I go through my back issues and correct the original articles accordingly. This saves me the agony of typing in an incorrect program, months after the correction was made available. If you follow my practice yourself, you should follow it for all programs, since you never know when your tastes will change, and you can't anticipate the taste of those who borrow your back issues.

Larry A. Shahan
Knoxville, TN

MAGAZINE INDEXES—Before putting my back issues into the storeroom, I remove the table of contents and place them in a file folder. By using this method, I can locate any previously published information in a matter of seconds.

R.V. Taylor
Little Rock, AR

REFERENCE BOOK—Place plastic index tabs on pages that you wish to use frequently in your favorite reference books. In my programmer's reference guide, I have tabs labeled ASCII codes, Memory Map, Error Messages and Abbreviations.

This system is a lot neater and more durable than using paper clips or dog-eared pages. Any office-supply store will have an assortment of different tabs for you to choose from.

Deb Sullivan
Pittsfield, MA

FREE LIBRARY SERVICES—Want to get your hands on a good computer book? Go to your local public library and talk to the people in charge. They *might* have just the one you're looking for. If they don't, they will welcome your suggestions.

If you get lucky, they'll enlist you as an unpaid computer book consultant, letting you help them by telling them what books to buy. They'll help *you* by taking your advice, which makes a lot of good reading material available to you.

By the way, be sure they know about the computer magazines that interest you—especially the new ones!

Mary Lee Resnick
Pittsburgh, PA

A GOOD COMPUTER BOOK—Want a very readable, very comprehensive guide to the world of computers? Want to learn about big systems as well as micros? If so, invest $3.95 in Radio Shack's *Understanding Computer Science*. It's a tutorial on the big picture of computers in our world, and it's sure to add to your stock of useful knowledge.

L.F.S.

CHIPS—If you'd like to know about the silicon chips that make your computer tick, the October 1982 issue of *National Geographic* is a good place to start. Most of that issue was devoted to explaining what chips are, how they are made and how they work. If you don't have that back issue yourself, check with your public library.

L.F.S.

MATHEMATICS

LARGE NUMBERS—When you need a large number such as 100,000,000, you can save time and effort by simply entering 10↑8. The up-arrow symbol tells the computer that the following number is an exponent.

Travis Stansbury
Oakridge, OR

ENGINEERING NOTATION—Sometimes it is convenient to express numbers in engineering notation (not scientific notation). In this notation, the mantissa is between 1 and 1000, and the exponent is always displayed in multiples of 3, so the units of measure are easily read. For example: E − 6 = micro, E3 = kilo, E6 = mega and so on. Below is a routine that displays any number X in engineering notation.

```
9000 IF X = 0 THEN E = 0:M = 0:
  GOTO 9030
9010 Z = LOG(ABS(X))/LOG(10):
  E = INT(Z):M = 10↑(Z + INT(Z))
9020 IF E/3 < > INT(E/3) THEN
  E = E − 1: M = M*10:GOTO 9020
9030 M = M*SGN(X):PRINT M;"E";E
```

To test this routine, add this statement:

```
10 INPUT "X = ";X
```

For example: 0.00137 becomes 1.37E − 3, as in milli(grams), and 6.25E − 7 becomes 625E − 9, as in nano(seconds).

Imre Auersbacher
Belleville, NJ

FACTORIALS—Some scientific calculators and computers have a factorial key or function (N!). Factorials occur often in mathematics and the sciences, and N! is defined as the product of all the integers between 1 and N, inclusive. It can be calculated by the following formula.

$$N! = N * (N-1) * (N-2) * \ldots * (1)$$

Commodore computers have no such function, but here is a one-liner that accomplishes the same task.

```
10 F = 1 : FOR Z = 1 TO N : F = F*Z :
  NEXT
```

After execution, F will contain

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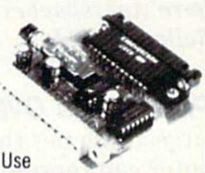

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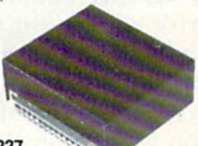

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N!. To test the program, you can add:

```
5 INPUT "N";N
20 PRINT "N! = ";F
```

Imre Auersbacher
Belleville, NJ

PREVENTING OVERFLOW—The largest number that your computer can represent is 1.70141183E + 38. If you attempt a calculation that exceeds this number, an Overflow error occurs, the program stops, and you are left without an answer. For example, in the usual program to calculate factorials, you will get an overflow for any N larger than 33. So if you want to compute 250!, you are in trouble.

You can avoid the overflow if you use logarithms in your calculations and output answers with a special Print statement. Using logarithms, products become sums, and you have:

```
5  F = LOG(1) : INPUT "N";N
10 FOR Z = 1 TO N : F = F + LOG(Z) :
   NEXT
20 F = F/LOG(10) : E = INT(F) :
   M = 10↑(F - INT(F))
25 PRINT "N! = ";M;"E";E
```

Running this for N = 250 gives you N! = 3.23285758 E 492.

When using logarithms, products become sums, division becomes subtraction and powers become products. For example:

```
LOG(A*B) = LOG(A) + LOG(B)
LOG(A/B) = LOG(A) - LOG(B)
LOG(A↑B) = B * LOG(A)
```

Imre Auersbacher
Belleville, NJ

ROUNDING OFF—The function FNR(N) may be used to round a number, N, to any required decimal position, DP. As with all user-defined functions, you must execute the Definition statement before using the function. And if there's an error in the Definition statement, the error message won't show it—it will indicate an error in the first line where the function is *used*! Here's the function:

```
10 DEF FNR(N) = INT(N/DP + .5)*DP
```

As an example, to round the value of Y to the nearest one-hundredth, type:

```
105 DP = .01 : Z = FNR(Y) : PRINT Z
```

and to round 27 times X to the nearest ten, type:

```
201 DP = 10 : T = FNR(27*X) : PRINT T
```

Chuck McGaffin
Ballston Lake, NY

UNIVERSAL ROUNDING ROUTINE—Give the following subroutine any number, positive or negative (NBR), and the number of decimal places you want (PLC). It will return your number, rounded to the number of places specified.

```
3999 REM UNIVERSAL ROUNDING
     ROUTINE
4000 IF NBR < 0 THEN NEG = 1
4005 MULT = 10↑PLC
4010 ADD = MULT/(MULT*MULT)
4015 NBR = MULT*ABS(NBR)
4020 L = INT(NBR)
4025 IF NBR - L<0.5 THEN NBR = L/
     MULT : GOTO 4035
4030 NBR = L/MULT + ADD
4035 IF NEG = 1 THEN NBR = - NBR :
NEG = 0
4040 RETURN
```

If you wish to divide A by B and put the result in C, with two decimal places, you could use this:

```
100 NBR = A/B : PLC = 2 : GOSUB 4000 :
    C = NBR
```

Be sure to precede the subroutine with an End statement, to keep the program from unintentionally executing it.

Carl W. Priepke
Milwaukee, WI

ROUNDING ERRORS—Here's a real puzzler. Type in the following program:

```
10 A = 5 : C = A*A : X = SQR(C)
20 PRINT "A = ";A
30 PRINT "X = ";X
40 IF A = X THEN PRINT "A = X"
50 IF A< >X THEN PRINT "A < >X"
```

When you run the program, you'll get A = 5, X = 5, A< >X. There's no mistake in the program. The answer lies in the way the computer calculates square roots. It uses logarithms, and, as a result, the answer will not always be an exact number but will often be rounded off when it is printed. If you enter PRINT SQR(5*5) - 5, you'll see the very small difference. Try it with other numbers if you'd like, and notice that some of them come out even.

Rosemary Melby
Billings, MT

ROUNDING ERROR PREVENTION—Basic's occasional rounding errors are more familiar than most of us would like. To see one in action, type and run the following simple loop.

```
10 FOR J = 0 TO 6 STEP 0.1
20 PRINT J
30 NEXT J
```

In line 10, you instruct the computer to increment the value of J, known as the index variable, from 0 to 6 in steps of 0.1. The first value to appear on the screen is 0, and the following numbers should be .1, .2, .3 and so on, up to a value of six.

When you run the program, the increment takes place, but it gets upset due to a rounding error in the value of 3.6. The value after that one is printed as 3.69999999, and the error is continued through the end of the loop.

To correct this, I have been using a method that will handle any increment in any kind of loop, at least as far as I have been able to test it. The method consists of reassigning the value of the index variable to itself by means of two string functions. To fix the errors in the above loop, add this line:

```
15 J$ = STR$(J) : J = VAL(J$)
```

Run the program and see that the numbers are now incremented correctly. This method slows program execution somewhat, but that's the price of accuracy.

Jose Miguel Gallego G.
Chula Vista, CA

ODD OR EVEN?—A fast way to tell if an integer is even or odd is to AND it with 1. If the result is zero, the integer is even; if the result is one, the number is odd. For the trick to work, your number must be in the range - 32768 to + 32767; otherwise, you will get an Illegal Quantity error.

Westmoreland Commodore Newsletter

LOGARITHMIC OPERATIONS 1—Basic's LOG and EXP functions work with so-called natural logarithms, which use the number constant *e* (2.71828) as a base. But most of us are more accus-

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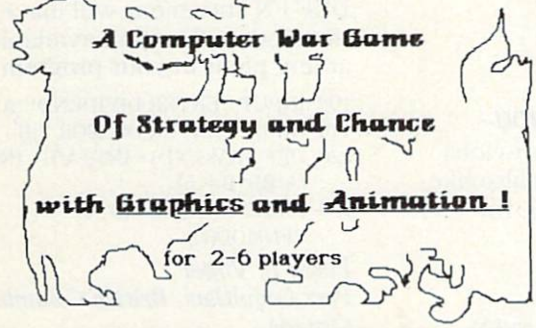

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tomed to common logarithms, those based on the number 10. You can easily define a function that will calculate logs to the base 10 with:

```
DEF FNL(X) = LOG(X)/LOG(10)
```

To use the function, execute the DEF statement early in your program. After that, any statement like

```
variable = FNL(expression)
```

will set "variable" equal to the common logarithm of whatever number "expression" equates to. Calculating FNL(1000) will return a value of 3, which any good math student knows is the common log of 1000.

EXP, LOG's sister function, calculates the value of *e* raised to the power within the parentheses. To define a similar function for 10 raised to the given power, use:

```
DEF FNE(X) = EXP(X*LOG(10))
```

If you try it, you'll find that FNE(3) = 1000, which of course is 10 raised to the third power.

Pascha Shum
Saskatoon, Saskatchewan
Canada

Finding Your Roots—Everyone knows that if the square root of X is required, SQR(X) will find it. But what do you do if you need a root other than the square root? The unvarying principles of mathematics let you use this:

```
NUMBER ↑ (1/ROOT)
```

For example, to derive the 16th root of 65536, enter the following in Direct mode.

```
PRINT 65536 ↑ (1/16)
```

Gene Amaya
Fountain Valley, CA

Inverse Sine Subroutine—The inverse sine, or ARCSIN, is an important function in many math and science disciplines. Given the sine of an angle, it returns the angle's size in radians.

Unfortunately, the ARCSIN we usually see in computer books gives a Division By Zero error when the input value is close to 1. The routine below corrects this deficiency.

```
5000 REM INVERSE SINE
       SUBROUTINE
5010 IF ABS(SN)> = .999999 THEN
       ANG = SGN(SN)*.5*[pi]:GOTO
       5030
5020  ANG = ATN(SN/SQR(1 - SN*SN))
5030 RETURN
```

Variable SN, an input, is the sine of the angle in question. Variable ANG, an output, is the angle itself, expressed in radians.

To convert radians to degrees, multiply by 180/[pi].

David Eagle
Littleton, CO

Inverse Cosine Subroutine—If you liked the previous trick on ARCSIN, you'll also like the following subroutine for finding ARCCOS.

```
6000 REM INVERSE COSINE
       SUBROUTINE
6010  IF ABS(CS)> = .999999 THEN
       ANG = SGN(CS)*.5*[pi] : GOTO
       6030
6020  ANG = ATN(CS/SQR(1 - CS*CS))
6030  ANG = .5*[pi] - ANG
6040  RETURN
```

Variable CS, the cosine of the angle in question, is the input to the subroutine. Variable ANG, the desired angle, is the output. As in all Commodore trigonometry, the angle is expressed in radians.

David Eagle
Littleton, CO

Modular Arithmetic—Modular arithmetic counts to a limit, then circles back. An example is the arithmetic found on clocks: even though hours increase forever, they are never registered beyond 12. A clock counts . . . 10, 11, 12, 1, 2 . . . and so on, in a method called modulo 12 addition. There are several ways of doing this on a computer, the most obvious being to increment a variable, then test it with an If . . . Then statement. The following line does it all at once, in one easy statement.

```
10 X = (X + 1) - INT(X/12)*12
```

Here's a more general form of doing the same thing for different modulos:

```
20 DEF FNM(X) = (X + 1) - INT(X/
     MAX)*MAX
```

The variable MAX should be the last number allowed before the counter rolls over to 1. Unlike much computer counting, modulo counting starts at 1 rather than 0.

Dave Straub
Petaluma, CA

Finding Remainders—If you do mathematical work, the modulo function may prove useful. It gives the remainder in a division operation. Using the DEF FN statement will make the modulo function available at any point in your program.

```
100  INPUT ''ENTER DIVIDEND'';A
110  INPUT ''ENTER DIVISOR '';B
120  DEF FNMOD(D) = INT((A/B - INT
     (A/B))*B + .5)
130  PRINT A'' MODULO ''B'' =
     ''FNMOD(D)
```

Peter L. Vogel
Port Coquitlam, British Columbia
Canada

Hexadecimal Counting—To learn about the hexadecimal numbering system, it's helpful to count things in hex. That's why we number our tricks hexadecimally. (In case you haven't noticed!) The "pound sign" or "number sign" shows that what follows is a number, while the dollar sign is a widely-used convention to indicate hexadecimal notation. There's also a convention for indicating binary notation—the percent sign—but it's not seen so often.

L.F.S.

Easy Hexing—If you can't handle hexadecimal in your head, here's something that will move you in that direction. Just memorize the fact that $1000 hex = 4096 decimal. Then use that information as a shortcut when using the SYS command to access hex locations.

For example, to access a program at $9000 hex, just type SYS 9 * 4096. To access one at $9008, just type SYS 9* 4096 + 8. If you go one step further and memorize the hex digits for decimals 10–15, it will be easy to use the SYS command to call $C000 (where there's a 4K block of protected RAM), by typing SYS 12 * 4096. That's a lot easier than trying to memorize 49152 (or is it 49512?—I *never* can remember for sure).

For more complex SYS calls, remember that $100 hex = 256 decimal, and $10 hex = 16 decimal. Then $CF83 easily becomes 12 * 4096 + 15 * 256 + 8 * 16 + 3.

Eric Haver
Squirrel Hill, PA

Hex-Dec Converter—This converts a four-digit hex number, expressed as string variable H$, to its decimal equivalent, expressed as numeric variable D. It is as follows:

```
100  D = 0:FORI = 1TO4:D% =  ASC(H$):
     D% = D% - 48 + (D% >64)*7:
     H$ = MID$(H$,2):D = 16*D + D%:
     NEXT
```

To see the routine in action, add these two lines, then run the program:

```
50  INPUT "HEX" ;H$
150  PRINT D
```

A.W. Grym
London, England

Dec-Hex Converter—A complementary one-liner is this decimal to hex converter, which converts decimal number D to its four-digit hex equivalent H$:

```
200  H$ = "":D = D/4096:FORI = 1TO4:
     D% = D:H$ = H$ + CHR$(48 + D% -
     (D% >9)*7):D = 16*(D - D%):NEXT
```

You can test the converter by adding it, plus 250 PRINT H$ to the program in the Hex-Dec Converter trick.

A.W. Grym
London, England

Easy Binary Conversions—Here's a good way to manually convert a decimal number to binary. Just keep dividing the decimal number by 2 and take the remainders as the bits of the binary number. The remainder from the first division is the least significant bit (LSB), and the remainder from the last division is the most significant bit (MSB). The following is an example of how to convert 19 decimal to binary.

```
19/2 = 9, remainder = 1 (LSB)
9/2 = 4, remainder = 1
4/2 = 2, remainder = 0
2/2 = 1, remainder = 0
1/2 = 0, remainder = 1 (MSB)
```

Tim Haresign
Storrs, CT

Decimal to Binary Converter—The following routine will convert a decimal number in the range 0–255 (D) to its eight-bit binary equivalent (B$).

```
50 B$ = "" : FOR X = 0 TO 7:
   B$ = CHR$(D AND 1 OR 48) + B$ :
   D = D/2 : NEXT
```

To test the routine, add the following lines.

```
40 INPUT "DECIMAL #";D
60 PRINT B$ : PRINT : RUN
```

Carl Onsgard
Green Bay, WI

Binary to Decimal Converter 1—This one-liner will handle any length number you wish to input. In addition, if you change the *2↑X in the middle of the line to *8↑X it will handle any length octal number. (To fit the converter on one line, you must abbreviate most of its keywords.)

```
2A = 1:FORX = LEN(B$) - 1TO1STEP -
1:D = D + (VAL(MID$(B$,A,1)))*
2↑X:A = A + 1:NEXT:D = D + VAL
(RIGHT$(B$,1))
```

Adding the following two lines gives you a working routine.

```
1  INPUT"BINARY #";B$
3  PRINT D
```

Frank Williams
Tucson, AZ

Binary to Decimal Converter 2—The following one-liner converts a binary string of any length (B$) to a decimal number (D).

```
10 D = 0 : FOR X = 1 TO LEN(B$) :
   D = D + D - (MID$(B$,X)> = "1"):
   NEXT
```

B$ should contain only 1s and 0s , but if it contains other characters, those less than 0 will be treated as 0s, while those greater than 1 will be treated as 1s.

You can test the routine by adding the following lines.

```
 5 INPUT "BINARY #";B$
20 PRINT D : PRINT : RUN
```

Carl Onsgard
Green Bay, WI

Base Conversion—The following short routine will convert from base 10 to any base less than 10. The most common would be base 2 or 8, but others are interesting and instructive. In line 15, the FNR function prevents rounding errors from disturbing the answer.

```
10 INPUT "DECIMAL #, BASE"; X1,B:
   X = X1:IFB<1 ORB>9 THEN10
15 DEF FNR(V) = INT(V + 1E - 8)
20 Y = INT(LOG(X)/LOG(B)): K = FNR(X/
   B↑Y)
30 X = FNR(X - K*B↑Y):Z = Z + K*10↑Y:
   IFX>0 THEN20
40 PRINT X1;"BASE 10", " = ";Z;
   "BASE";B
```

Donald T. Jacobs
Wooster, OH

Low Byte/High Byte Conversions—When working with pointers in memory, you soon encounter their unusual way of representing addresses. Since addresses can range from 0–65535, and since one byte in memory can only hold numbers from 0–255, two bytes of memory must be used to specify one address. One byte holds the number of 256s in the subject address, while the other holds the number of 1s. It's sort of like place value in decimal addition, where one column holds the number of 10s and another holds the number of 1s.

The first byte of the pointer holds the number of 1s, while the second byte holds the number of 256s. The first byte is called the low byte, while the second is called the high byte. To determine the decimal address to which a pointer points, you multiply the high byte by 256, then add the low byte. Once you understand the principle, it is quite straightforward.

To convert a two-byte pointer, whose low byte is at P, to the equivalent decimal address A, you can use the following.

```
100 LB = PEEK(P) : HB = PEEK(P + 1) :
    A = LB  +  256*HB
```

To convert a decimal address into a two-byte pointer, use:

```
200 HB = INT(A/256) : LB = A - 256*HB
```

Other methods work just as well, but understanding them requires some expertise in Boolean operations. For example:

```
300 HB = INT(A/256) : LB = A AND 255
```

will work as long as A is less than 32767.

If you use an integer variable for the high byte, things become even simpler:

```
400 HB% = A/256 : LB = A AND 255
```

You can teach yourself about low byte/high byte matters by entering various addresses as you run the following program.

```
390 INPUT "ADDRESS";A
400 HB% = A/256 : LB = A - 256*HB%
410 PRINT "LO BYTE = "LB
420 PRINT "HI BYTE = "HB%
430 PRINT : RUN
```

To start with, some interesting values of A are 0, 1, 255, 256, 257, 65534 and 65535.

Robert Fiske
Los Angeles, CA

PROGRAM LIBRARY

LABELING HINT—One of the handiest ways to attach notes to disks, monitors and drives is with 3M post-it pads. These small, usually yellow, pads can be bought in several sizes at any office supply store. Each sheet has a special glue that allows it to stick to almost any surface, leaving no residue when it's removed. Of course, you don't want to put it on the magnetic part of a disk, but anywhere else, this paper can be removed and replaced several times without ill effects.

Ira Hertzoff
Columbus, OH

PROGRAM LIBRARY HINT—Code your magnetic media with the colored dots available in any stationery store. I use orange for games, blue for utilities and green for business application programs.

Ted P. Rogers
Oxford, NJ

MORE COLOR CODING—Our tape storage boxes are color coded for each member of the family. We color a piece of masking tape with a crayon or marker and put a piece on the cassette to match the storage box. That way, tapes left in the Datassette always find their way home.

Sally Smiley
Louisville, KY

CARTRIDGE HINT—Use adhesive labels to mark your plug-in cartridges. Place the labels so you can see them at a glance when the cartridge is plugged into the computer. Then you will no longer have to unplug your cartridges to see which ones they are, and your cartridge port will last a lot longer.

Greg McMahan
Cincinnati, OH

NAMING PROGRAMS 1—Here are some hints for naming your programs in useful and/or interesting ways.

When developing and saving a program, it's frequently useful to make the date and time when you saved it a part of the program's name. Using the military style 05291252 takes only eight characters to say 12:52 PM, May 29. Since program names can be up to 16 characters, you have eight left for identifying the program itself.

Along the same lines, you can automate things a bit by using

```
SAVE"PROGNAME" + TI$
```

which will append the value of TI$ to your name. Here you have to be careful that the name + TI$ is 16 characters or fewer, and that resets of TI$ don't confuse you. TI$ is reset by turning on the computer, by using a reset button and by setting TI.

When saving to tape, you can include cursor controls, RVS on and off, color keys and so on as part of your program's name. The effect can be exciting, but whenever you're loading the program by name, you must include the special symbols.

When saving a machine language program, make its SYS call a part of its name. That way, when you see MONITOR 828 on a directory or elsewhere, you'll know in a flash that it's an ML program, and that it's called with a SYS828.

L.F.S.

MAGIC NAMES—When you save a program to disk or tape, save the name of the program with a CHR$ code:

```
SAVE CHR$(0) + "programname",8
```

Now the program can only be loaded with the CHR$ code. Note the unusual way the program's name is saved in the disk directory.

Bart van Baren
Wageningen, The Netherlands

NAMING PROGRAMS 2—When naming programs that require special peripherals or memory configurations, I make those special conditions part of the name. For example, "CLOCK - SE - 16K" lets me know that the Super Expander and 16K RAM are needed to run the Clock program. If you adopt a code for these things and stick with it, you'll find your directories give you lots of information about your programs.

Jerry Carson
Berkley, MA

PROGRAMMING TECHNIQUES

LINE NUMBERING HINT—If you have ever accidentally erased line 2 of a program you are typing, because you fumble when you are typing a quotation mark or W, here's a simple solution: stop using 2 as a line number!

David E. Amos
Folsom, WV

NON-DELETABLE LINE—Basic line numbers range from 0 to 63999, and if you try to enter a line with a number outside this range, you'll get a Syntax error. But Basic will list lines outside the range if they exist and we can *make* them exist by Poking them directly. To do it, put a program in memory, then enter the following in Direct mode.

```
PRINT PEEK(45) + 256*PEEK(46) + 1
```

Jot down this number as it appears on the screen. This is X, the current end of Basic, and X will be the location of the next line number entered into your program. Now enter:

```
63744 REM (or any legal program line
with this number)
```

List the program and observe that line 63744 is at its end. Now enter:

```
POKE X,250
```

where X is the number you previously wrote down. List your program, and observe that you now have a line 64000. You can now do whatever you'd like to the rest of the program—add, delete, edit—but you can't do anything to line 64000.

Robert A. Rupp
Rochester, MI

RENUMBERING HINT—A renumbering utility can be a godsend, but when you renumber, you lose track of the starting lines of your program's various parts. You can find them again if you put dummy lines, like the following, at the end of your program.

```
63950 END
63952 GOTO 1000 : REM START SUBS
63954 GOTO 2000 : REM PRINT MENU
63956 GOTO 3000 : CALCULATE
  TOTAL
```

The End statement prevents these lines from being executed. The renumbering automatically changes the GOTOs, so when you examine these lines, you'll know where everything is. If you've put these lines at the end of the program, examining them should be a snap.

Terry Neely
Norcross, GA

NUMBERING YOUR SUBROUTINES—During the writing of a lengthy program, you may have several GOTO or GOSUB statements for which you haven't yet written the target line. To mark these statements for future completion, use a line of asterisks, plus signs or other similar characters. These will attract your attention when you go back through the program.

Roberta London
Houghton, MI

VARIABLE NAMES—If you run this:

```
10 TOP = 65
20 BOTTOM = 90
30 PRINT BOTTOM - TOP
```

you will get a Syntax error, because TO, a Basic keyword, is embedded in each of the variable names. You can trick the computer by placing a graphics character inside the keyword. Try this:

```
10 T{shift J}OP = 65
20 BOTT{shift J}OM = 90
30 PRINT BOTT{shift J}OM - T{shift
  J}OP
```

The program will run perfectly, giving an answer of 25. When you list the program, you won't see the shifted characters at all, but they're in there just the same.

Nick Proakis, Jr.
Aliquippa, PA

DEFEATING PROGRAM PROTECTION—If you ever try to list a program and the listing terminates suddenly with an empty REM statement followed by a Syntax error, the cause is a shifted L following the REM. You can clear up the list disable by moving the cursor to the colon, then using the space bar to delete the colon and the REM.

Your program should then list perfectly, and unless the program protector was especially sneaky, it should run perfectly, as well.

Paul James
Cleveland, TN

APPENDING PROGRAMS—Here's a way to append one Basic program onto the end of another. It's a Direct mode technique, but you could make a program of it if you'd like. Load your first program, then enter:

```
PRINT PEEK(43)PEEK(44)PEEK(45)
```

Write down the first two numbers that the computer returns. If the third number is 2 or more, then enter:

```
POKE43,PEEK(45) - 2:POKE44,
PEEK(46)
```

If the third number is 0 or 1, then enter:

```
POKE43,PEEK(45) + 254:POKE44,
PEEK(46) - 1
```

Next, load the program you want to append. It *must* have line numbers higher than those in the first program. Finally, enter:

```
POKE43,x:POKE44,y
```

where x and y are the first and second numbers you wrote down above. List the program, and you'll find that the second program has been attached to the first. You can repeat this whole process to append even more programs to the first two.

Frank Tymon
Lancaster, CA

SIMPLE SORT—If you ever have to put a list of numbers into numerical order, you can have your computer do it without even entering a program.

As long as the numbers are integers between 0 and 63999, just type the number, then type any letter or punctuation mark and press the return key. After all the numbers have been entered in this manner, type LIST, and you'll see that all the numbers are in order.

It's easy to see that the computer interprets those numbers as line numbers; of course, each number will only appear once in the computerized list, no matter how many times it occurred originally. And if your original list is of numbers *plus* other information, you can enter the other information after you type the number, instead of just pressing a key for a letter or punctuation mark. For example, enter:

```
5 GOLDEN RINGS
1 PARTRIDGE IN A PEAR TREE
3 FRENCH HENS
2 TURTLEDOVES
4 CALLING BIRDS
```

It won't list in the classic sequence, but it *will* make order out of chaos.

Richard Bell
Atwater, CA

SCREEN FRAMING—Here's another "antiquity," this time from the first issue of an old newsletter called *The PET Paper* (circa 1978). The routine prints a frame around the screen of a Commodore PET, but it works fine for a C-64. If you change a few numbers, it will also work on the VIC-20.

```
3000  REM ** FRAME ROUTINE **
3010 PRINT "[clear]";:FOR I = 1TO39:
      PRINT F$;:NEXTI:PRINT
      "[cursor up]"
3020  FOR I = 1TO23:PRINT
      F$TAB(38)F$:NEXTI
3030  FOR I = 1TO39:PRINT
      F$;:NEXTIPRINT "[home]"
```

In this routine, F$ can represent any character. You can replace F$ in the routine with your favorite character (enclosed in quotes, of course) or change F$ each time you draw the frame. For example: 40 F$ = "X":GOSUB 3000.

But remember—if you use this

routine as a subroutine, you must add a line 3040 Return, and you need an End statement somewhere above the routine so you don't fall into it as your program executes.

The PET Paper

HEADINGS—Here's how you can make a heading at the beginning of a program when you list it. Enter:

```
0 REM "'"[DELETE][RVS ON]
TTTTTT[RVS OFF]NOW TYPE THE
HEADING
```

Douglas J. Coffman
Portage, MD

INDENTED LISTINGS—You can indent Basic program lines by using shifted characters. To indent a line, type the line number, then any shifted letter, then any number of spaces, then the material you want on the line. When the line is listed, the shifted letter will be ignored, but the leading spaces won't. To have a completely blank line, enter the line number, a shifted letter, a space and another shifted letter. Neither of these procedures will affect execution of your program in any way. Editing an indented line will remove the indentation.

Ronald LaPread
Detroit, MI

DETECTING KEYPRESSES—When using GET to detect a keypress, the fact that previous keystrokes are saved in the keyboard buffer can be a nuisance. Often, when a game is finished, you will want the player to restart the game by hitting a key. Here is a common way to do it:

```
510 PRINT"PRESS ANY KEY TO RUN"
520 GETA$:IFA$ = "" THEN 520
530 RUN
```

Those lines will run the program again even if a key was hit *before* line 510 is executed. You can fix the problem by adding the line 500:

```
FORI = 1TO10:GETA$:NEXT
```

You can do the same thing in *one* line by replacing lines 500–530 with this:

```
500 PRINT "PRESS ANY KEY TO
    RUN":POKE198;0:WAIT198,1:RUN
```

"POKE198,0" clears the keyboard buffer. "WAIT198,1" tells the computer to sit there and wait until a key is pressed.

Westmoreland Commodore Newsletter

KEY SENSING—Memory location 653 can be used to sense the status of three non-printing keys on the VIC or C-64. The usual value in 653 is zero, but it changes when these keys are depressed:

shift key = 1
Commodore key = 2
CTRL key = 4

The values are additive; Shift/CTRL will generate a five, Shift/Commodore, a three and so on. You can examine this feature in detail by typing:

```
10 PRINT "[clear]"PEEK(653) : GOTO
  10
```

Run the program and press the various keys.

Quyen N. Truong
Address Unknown

KEYPRESS DETECTION—The content of memory location 197 is determined by the key that is pressed at any given instant, and that fact can be used to advantage in programming. If no key is pressed, PEEK(197) = 64. Other keys change the Peek, but to different numbers on the C-64 and VIC-20. Table 1 gives the values for both machines. If several keys are pressed at once, 197 will respond to the key with the highest value in the table. Memory location 203 holds the same value as 197, so you can use the two interchangeably.

Notice that these locations don't respond to the shift, control, Commodore or restore keys.

Tom Hoppe
Spokane, WA

WAITING FOR INPUT—At some time or another, most programs need to pause to give the user time to read instructions or other information on the screen. Usually, programmers use a Get loop to allow this pause, but there's a much better way: Use the statement WAIT653,1 to freeze the computer until the shift key is pressed.

If there are several pages of instructions with a WAIT653,1 at the end of each page, you can rapidly skip through the pages just by holding down the shift key. If you want to avoid this, put WAIT653,1,1 after each WAIT653,1. This requires you to press and release the shift key before proceeding.

Randy Palermo
Fort Jones, CA

SUBSCRIPTED VARIABLES—When using subscripted variables such as A(4), the operating system automatically reserves 11 elements without having to declare a dimension with DIM. (Elements 0 through 10 inclusive.)

If, however, you are short of memory and are using fewer than 11 elements per variable—say four—it will save memory if you dimension the array. For example:

```
10 DIM A(4),C$(3)
```

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KEY	C-64	VIC	KEY	C-64	VIC	KEY	C-64	VIC	KEY	C-64	VIC	KEY	C-64	VIC
A	10	17	N	39	28	1	56	0	f1	4	39	←	57	8
B	28	35	O	38	52	2	59	56	f3	5	47	+	40	5
C	20	34	P	41	13	3	8	1	f5	6	55	–	43	61
D	18	18	Q	62	48	4	11	57	f7	3	63	£	48	6
E	14	49	R	17	10	5	16	2	SPACE	60	32	@	46	53
F	21	42	S	13	41	6	19	58	RETURN	1	15	*	49	14
G	26	19	T	22	50	7	24	3	STOP	63	24	↑	54	54
H	29	43	U	30	51	8	27	59	HOME	51	62	:	45	45
I	33	12	V	31	27	9	32	4	DELETE	0	7	;	50	22
J	34	20	W	9	9	0	35	60	CRSR DN	7	31	=	53	46
K	37	44	X	23	26				CRSR RT	2	23	,	47	29
L	42	21	Y	25	11				NO KEY	64	64	.	44	37
M	36	36	Z	12	33							/	55	30

Table 1. Values of PEEK(197) for various keys on C-64 and VIC-20.

VIC MEMORY SAVER—If you wish to add instructions to a program that uses up all of the available memory in your VIC, then make the instructions a separate program by adding the following line to the end of the instructions.

```
1000 POKE198,1:POKE631,131:NEW
```

Now save the instruction program to tape, followed by your regular program. This one line will load and run your second program and clear out the instructions.

Larry Mudge
Winnipeg, Manitoba
Canada

TIMING EXECUTION—Here's how you can time the execution of two similar pieces of code:

```
100 TI$ = “000000”
110 FOR I = 1 TO 500
120 Code to be tested goes here.
130 Etc.
140 Etc.
180 NEXT
190 PRINT TI
```

Run the program with one version of your code, and note the value of TI, which is the number of jiffies it took to execute 500 times. Then replace your test code with the other version and run the program again. The version taking fewer jiffies is faster.

L.F.S.

DECREASING EXECUTION TIME—In a program that has a stack of If statements, place the decision with the highest probability at the top of the stack. Better yet, replace the Ifs with ON. . .GOTOs, if possible.

Also, place frequently used subroutines at the beginning of your program, and use a GOTO to jump around them when the program is first run. Since the search for subroutines starts with line number zero and continues in ascending order, the subroutines with low line numbers will be found faster.

Wayne Robotham
Kingston, Jamaica

DELAY LOOPS—To put time delays in programs, I prefer using the internal time clock to a For. . .Next loop. By using the TI function, I know just how long the delay will be. For example, for a two-second delay, use two program lines like these:

```
310 T = TI
320 IF TI < T + 120 THEN 320
```

To get a shorter or longer delay, change the 120 to a smaller or larger number. Every difference of 60 will make a one second difference. Use 30 for a half second, 90 for 1.5 seconds, 180 for three seconds and so on.

Some other uses I have found for the time function are:

(1) Control the length of time something is left displayed on the screen.
(2) Control the amount of time allowed for input when using the Get statement.
(3) In some game or education programs, calculate the length of time required for input and give a score for speed.

Ed Heinen
Bison, KS

DELAY LOOPS—If your program has many For. . .Next loops to create delays, you can put them in subroutines to save time and memory. Here's an example for delays of various lengths:

```
900 REM DELAY LOOPS
901 FOR I = 1 TO 1000 : NEXT :
    RETURN
902 FOR I = 1 TO 2000 : NEXT :
    RETURN
903 FOR I = 1 TO 3000 : NEXT :
    RETURN
```

Now when you want a delay in your program, just type GOSUB 901 or GOSUB 902 and so on. Notice how the line numbers make it easy to remember the length of the delay.

You should write subroutines only for delays that you'll use at least twice in the program; otherwise, it's not worth the extra effort of setting up this system.

William W. Braun
Arnold, MO

PRECISE TIME DELAYS—You can set a time delay to within a 60th of a second by using something like this:

```
10 T = TI
20 IF (TI – T) < 90 THEN 20
30 PRINT “DELAY WAS”;TI – T;
   “JIFFIES”
```

A jiffy is one count of the TI timer, which ticks 60 times each second in the U.S., or 50 times per second in Europe. If you've read your user's manual, you know that TI can be reset only by resetting its companion variable, TI$. TI$ can be reset by something like TI$ = “123456” or by resetting your computer.

Lee Housman
Norwalk, CT

VIC TO 64 CONVERSION—If you have some VIC programs that you want to run on your C-64, add this line:

```
PRINT“{SHFT CLR}”:IF FRE(X)<0
THEN POKE 53280,3 : POKE 53281,1
```

It will set the C-64 colors to the VIC defaults—white screen with cyan border. The If. . .Then statement allows the program to run on either computer, since the FRE function is negative on the C-64 for programs that use less than 32K bytes of memory.

Calvin C. Guild
Houston, TX

UNIVERSAL VIC PROGRAMS—You can write your VIC-20 programs to work with any memory configuration from the minimum up to fully expanded, just by using this line:

```
S = 4*(PEEK(36866)AND128) + 64*
(PEEK(36869)AND112):C = 37888 + 4*
(PEEK(36866)AND128)
```

The variable S is the starting location of screen memory, and C is the starting location of color memory. If you Peek and Poke to the screen by using these two variables, you won't have to be concerned with finding the start of screen or color memory.

Michael Caldwell
Burlington, WV

CODE CONVERSION—Have you ever wanted to convert a character's Commodore ASCII representation to its screen Poke code? The following function will do it perfectly for every character.

```
DEF
FNF(A) = A – 161 – 33*(A < 255) – 64*
(A < 192) – 32*(A < 160) + 32*(A < 96) –
64*(A < 64)
```

The function, usable on both the VIC and C-64, will convert any ASCII value A to its proper code, ready for Poking to the screen. What good is such a function? Well, consider that some word processors store text on disk in ASCII while others use screen codes. It's a good way to convert between the two! Other uses will be found in educational software, graphics programs and general utilities.

For PET/CBM machines, the function is much simpler, and is presented here for owners of those computers.

```
DEF FNF(A)=((A AND 128)/2) OR
(A AND 63)
```

It fails to convert CHR$(255) properly, but works for all the rest.

Thomas Henry
Mankato, MN

REVERSE CODE CONVERSION—The following line of code will convert any Commodore screen code value to the corresponding Commodore ASCII code.

```
A=A+128*(A>127):A=A-64*(A<32
ORA>95)-32*(A>63ANDA<96)
```

Input any screen code value between 0 and 255. Output equals the ASCII value (32 to 127 or 160 to 191).

Edward Guancial
Columbus, OH

STRING HANDLING—One little-known use of the MID$ function is remainder string. If the third parameter of the MID$ function is omitted, the resulting string will be every character to the right of the specified start position for the string being operated on.

For example, if A$ = “123456789”, then MID$(A$,2,4) is “2345”. But MID$(A$,2) is “23456789”.

This is not the same as RIGHT$, since that function returns an absolute number of characters starting from the rightmost position. This application works best when the right-hand portion of a string is wanted and the string length is not known.

The Transactor

WORKING WITH CHR$ CODES—Any CHR$ code, or any combination of codes, can be assigned to an ordinary string variable. Doing this often makes it easier to use the codes in programs. For example:

```
100  CS$=CHR$(147) : REM CLEAR
     SCREEN
200  PRINT CS$ “HELLO”
```

The string-based codes can also be sent to any peripheral device, for example:

```
400  SO$=CHR$(14) : SI$=CHR$(15) :
     CR$=CHR$(13)
410  OPEN 4,4
420  PRINT#4,SO$“DOUBLE WIDTH
     PRINTING”
430  PRINT#4,SI$“NORMAL
     PRINTING”
440  PRINT#4,CR$
```

They can also be used together:

```
500  ES$=CHR$(27) : A$=CHR$(0) :
     B$=CHR$(1)
510  PRINT#4,ES$“W”B$“DOUBLE
     WIDTH”
520  PRINT#4,ES$“W”A$“NORMAL
     WIDTH”
```

And they can be concatenated:

```
600  DW$=ES$+“W”+B$ : NO$=
     ES$+“W”+A$
610  PRINT#4,DW$“DOUBLE WIDTH”
620  PRINT#,NO$“NORMAL
     PRINTING”
```

These CHR$ codes and combinations are given as examples, and might not work on your printer. The technique, however, will work with all combinations and peripheral devices, as well as on the computer alone.

Allen Ross Brier
Houston, TX

GRACEFUL EXITS—Many programs execute Pokes to pointer locations for the purpose of setting up custom characters or reserving space for machine language subroutines. If these programs are simply terminated with End or a keyboard stop/restore, the pointers remain set to their new positions. When the next program is loaded and run, you may get an Out Of Memory error or other strange effects. To avoid the problem, try adding the following routine to your program at a logical point.

```
5010  PRINT “C=CONTINUE Q=QUIT”
5020  GET A$
5030  IF A$=“C” THEN (the
  appropriate line number)
5040  IF A$=“Q” THEN SYS64802
  (or 64738 for a C-64)
5050  GOTO 5020
```

When your program encounters the routine, if you select Q, you'll cause a cold start, resetting all pointers, color, sound and so on to the “seed” state, and you'll also reinitialize the program. This is a tidy way to exit a program and will save wear and tear on your power switch.

Allan E. Wheeler
Paso Robles, CA

DYNAMIC KEYBOARD EXPLAINED—It's easy to make a program simulate keypresses, with truly magical effect. The technique has been around since at least 1978, and it's commonly called *dynamic keyboard*. The basic idea is to have your program Poke the CHR$ values of one or more characters into the keyboard buffer area of memory. When the program is finished, the computer will print the Ready prompt, then respond as though you've *typed* the Poked characters.

The keyboard buffer occupies the ten memory locations from 631–640 decimal. It works in conjunction with location 198, which must always hold a count of the characters Poked into the buffer. Run the following little program to see the principle in action.

```
10  FOR I=1 TO 10 : POKE 630+I,65 :
    NEXT : POKE 198,10
```

You should get the Ready prompt, followed by a series of ten A's (CHR$(65) is A). Change the 65 to 64+I, and you'll get the first ten characters of the alphabet. Change the 10s to smaller numbers, and you'll get fewer letters.

Dynamic keyboard's *real* magic comes when your program prints an executable statement on the screen, then makes the Ready prompt appear on the line above it, so the cursor ends up on the executable line. If the buffer holds a 13, it's just like putting the cursor on that statement and hitting the return key; your computer will do whatever the statement tells it to do.

Clever programmers can print up to *ten* Direct mode lines, with proper spacing between them, then put CHR$(13)'s into the buffer, causing all those

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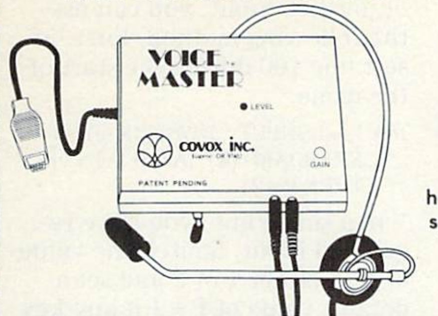

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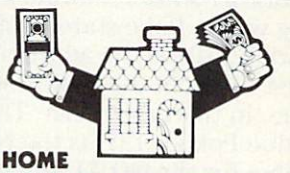

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lines to be executed. The key to success is careful placement of the screen commands and careful positioning of the cursor at the moment the program ends.

Several of this month's tricks incorporate the dynamic keyboard technique. Now that we've explained it, try to figure out how they work.

Robert E. Peary
Cresson, PA

COMPUTED GOTO—This routine will let you go to a computed line number, that is, to a line number held in a variable. It prints to the screen, so it's not usable in all circumstances. If AA is the computed value, type:

```
100 PRINT"{SHFT CLR} {3 CRSR DNs}
    GOTO"AA "{HOME}" : POKE
    198,1 : POKE 631,13: END
```

The PET Gazette

SELF-MODIFYING PROGRAMS—It's easy to make programs work differently each time they're run. Our example is for an unexpanded VIC, but the equivalent of 4101 for your own computer can be found by

```
EQ = 4 + PEEK(43) + 256*PEEK(44)
```

List #1	List #2
0 REM 200	0 GOTO 200
100 Routine #1 goes here.	100 Routine #1 goes here.
199 POKE 4101,137 : END	199 POKE 4101,137 : END
200 Routine #2 goes here.	200 Routine #2 goes here.

List #1 shows Routine #1 ending with a Poke statement. Location 4101 is the address of the first token in the first program line, in this case, REM. The value Poked, 137, is the token value for the GOTO statement. List #2 shows the result after the first program is run. The REM is now a GOTO, thanks to the previous Poke. Any runs thereafter will proceed according to List #2. Adding POKE 4101,143 to the end of Routine #2 will cause the program to self-modify back and forth between List #1 and List #2 each time it's run. There are many possible uses of this trick, if it's properly understood.

Gerald Mallonee
Simi Valley, CA

CLOSING FILES—Leaving open files can be disastrous, and it often happens when your program crashes unexpectedly. You're never sure *which* files are open, and going through a list of Close statements can be the ultimate in tedium. SYS65511 closes all open files automatically and easily.

Kenneth H. Stroebel
Murrysville, PA

MULTIPLE-CHOICE BRANCHING—There are times when it would be nice to have a test of a condition that does not default to the next line of Basic. By adding an If. . .Then statement before an ON. . .GOTO, we can have a "multiple-choice" branch, such as:

```
10 IF A>B THEN ON -(B=0) GOTO
   100: GOTO 200
20 REM Continue if A not>B
```

Let's look at the possibilities of this example. If A *is not* greater than B, then line 20 would be executed. If A *is* greater than B and the condition in parentheses, B=0, *is also* true, then program control goes to 100. Finally, if A *is* greater than B and the condition in parentheses *is not* true, then GOTO 200 is executed.

This is similar to the If. . .Then. . .Else statement in some forms of Basic. Of course, you could have another ON. . .GOTO or If. . .Then statement or whatever in place of the GOTO 200, and the condition in parentheses can be anything allowable. This can at times give you some nifty code that saves several lines of testing.

Doug Smoak
Columbia, SC

BRANCH ON SIGN—Sometimes it's necessary to go to a specific line number based on the sign of a Basic variable. The following line will branch to 100 if A is negative, 200 if A is zero or 300 if A is positive.

```
10 ON (2+SGN(A)) GOTO 100,200,300
```

This is essentially a Basic version of Fortran's sign-branch construct.

David Eagle
Littleton, CO

INPUT SELECTION—To allow easy choice of either keyboard or joystick input, you can use the following method. First, insert line 100 during the start of the game.

```
100 P=1: INPUT "JOYSTICK (J) OR
    KEYBOARD (K)";A$: IF A$ = "K"
    THEN P=2
```

In a single line, you have requested input, limited the value of P to either 1 or 2 and set a default value of P=1 if any key other than K is pressed.

To check for movement, simply insert line 200.

```
200 ON P GOSUB 50,75
```

Here the joystick subroutine lies at line 50 and the keyboard subroutine starts at line 75. Line 200 is an often-overlooked form of branching, yet it uses less space than the usually encountered

```
200 IF P=1 GOSUB 50
210 IF P=2 GOSUB 75
```

Note that by placing the invoked subroutines near the beginning of the program, you'll speed up the execution time, which is important for subroutines called as often as these usually are.

Steve Hite
Metairie, LA

SOMEWHAT-RANDOM NUMBERS—When you need a quick random integer that doesn't have to be perfectly random, a simpler and faster way than using the RND function is to look at the system clock. You can replace:

```
X = INT(256*RND(-1))
```

with:

```
X = PEEK(162)
```

This yields an integer value ranging from 0 to 255. It isn't perfectly random, since it cycles from 0 up to 255 every four seconds, but it's fine for a quick random guess.

If you need a smaller integer, say from 0 to 15, you can use a Boolean operator:

```
X = PEEK(162) AND 15
```

If you want only even numbers, you can use:

```
X = PEEK(162) AND 254
```

Ian Adams
Vancouver, British Columbia

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$29⁹⁵

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TIMEKEEPER 1—If you want an easy way to keep track of time while programming, try this: As soon as you turn on your computer, type the following in Direct mode:

```
TI$ = “hhmmss”
```

where hhmmss is the correct time in hours, minutes and seconds. Then whenever you want to know the time, just type PRINT TI$, and your built-in clock will tell you. You should note that the clock isn't extremely accurate and will be slowed down by tape operations, but it's good enough for most purposes.

Darren Atwater
Delta, British Columbia
Canada

TIMEKEEPER 2—I've found that using a time delay with the TI$ variable works nicely with only two lines:

```
10  TI$ = “000000”
20  IF TI$ < “000013” THEN 20
30  Continue program here.
```

This delay will last for twelve seconds. As many of us know, the format of TI$ is HHMMSS, where HH is hours, MM is minutes and SS is seconds. HH takes the 24-hour, or military-time, format.

Robert Jenkins
Glenpool, OK

BOOLEAN OPERATORS—Many If. . . Then statements can be easily replaced by Boolean operators. They work on the simple principle that statements are either true or false. If a statement is true, Commodore computers assign it a value of −1. False statements are assigned a value of 0. Usually the statement to be evaluated is placed in parentheses, to avoid unforeseen coupling to adjacent statements. You can see some of this for yourself by entering the following in Direct mode.

```
PRINT (1 = 1)
PRINT (1 = 2)
```

If you're new to Boolean operators, you may be surprised that such unusual-appearing statements give results of −1 and 0, respectively.

To produce results other than −1 or 0, you can multiply the initial result by any number you'd like. Thus, the statements:

```
IF A>B THEN C = 4
IF B>A THEN C = −4
```

can be replaced by the single Boolean statement:

```
C = −4*(A>B) + (B>A)
```

George Hu
Renton, WA

LOGICAL OPERATORS—When using the logical operators AND and OR along with the relational operators =, <, > and their various combinations, AND may be replaced by a *, and OR may be replaced by a +. For example:

```
10 IF (A = 3) AND (B>C) OR (C< = D)
   THEN 90
```

can be written instead as:

```
10 IF (A = 3) * (B>C) + (C< = D)
   THEN 90
```

When using this method, the relational tests must be placed inside parentheses. If they aren't, for example, the computer would multiply 3*B in line 10 above.

Imre Auersbacher
Belleville, NJ

USING A BASE ADDRESS—When writing a program that uses many Pokes to the same area of memory, create a variable with a value equal to the starting address of that area. Then you can do your Pokes to an offset of the variable. This reduces the typing and memory requirements compared to using direct addresses. This may also increase execution speed. Another advantage is that if the position of the Poked block of memory must be changed, you can do it just by changing the base address. For example:

```
100 SCREEN = 1024 : COLMEM =
    SC + 54272
110  POKE SC + 10,18 : POKE CO + 10,7
120  POKE SC + 11,21 : POKE CO + 11,7
130  POKE SC + 12,14 : POKE CO + 12,7
```

Frank Colosimo
Rochester, NY

PROGRAMS, COMMERCIAL

COMMERCIAL SOFTWARE—Many software packages contain instructions on the disk as well as in the manual. When you get a new software package, try listing the directory by entering LOAD“$”,8 followed by LIST. You'll often be surprised at the amount of additional material on the disk.

My copy of Easy Script contained three sequential files: ALLDEM is a description of the package; 1515UNDERLINE is a demo of ways to underline text using graphics on the 1515 printer; and MX80/FX80INFO tells how command codes are sent to Epson and Gemini printers to take advantage of their special features. None of this material appears in the Easy Script manual.

Ira Hertzoff
Columbus, OH

PROGRAM INSTRUCTIONS—Once you have a word processing program that lets you save text files, use it to save instructions for your programs on the same disk as the programs themselves. This minimizes the hazard of misplacing the instruction sheet, because you can always run another off on your printer. It also makes it more convenient to copy disks of your own programs for friends' use.

Albert Wellman
Santa Rosa, CA

SOFTWARE UPDATES—Some companies that provide copy-protected software offer backup copies at nominal extra cost. I recently sent for a backup of Multiplan and received an upgraded version, thanks to the generosity of the publisher. If you buy costly software, it definitely pays to study the procedures for obtaining backup copies and upgrades.

Ira Hertzoff
Columbus, OH

COMMERCIAL PROGRAM HINT—If your system has only one disk drive, you're faced with a problem while using word processors, spreadsheets and the like. The master disk, since it holds a long master program and often several subprograms, has relatively little space remaining for files. In addition to being long, the master program is often copy-protected. Most of us keep our data files on separate disks; we load the main program, then swap the master disk for a data disk.

The problem with this is that we have to reinsert the program disk whenever we need to use a subprogram. I've found that these subprograms are usually rather short and usually can be easily copied. So whenever I start a data disk, I also put my frequently used subprograms on it, to save time and effort in the future. With Multiplan, I put MP.SYS and MP.DATA on every data disk, leaving 517 blocks free for files. I definitely eliminate the seldom-used MP.HLP, which is 152 blocks long.

Bob Becker
Austin, TX

MAKESHIFT DIRECTORY—Some popular application programs like PractiCalc and HESWriter have no built-in provision for reading the disk directory. When you want the directory, you must exit the program, list the directory, reload the program, then start again. You can get around this problem by setting up a pseudodirectory in one of the application program files. Have the program load your pseudodirectory, then read it to find the name of the file you're looking for. Remember to update the index file every time the program saves an important new file to disk.

D.L. Jassby
Princeton, NJ

COMMODORE WORD PROCESSORS—I've found only one frustration in using Commodore's Easy Script and Magic Desk word processors: I never can tell when I've typed to the end of the monitor screen paper, so I often type over the lines I've already entered.

The solution is easy. Before starting to type, just use the joystick to move to the point on the screen paper where you wish your typing to end, then type an X or some other mark in the corner. Then return your cursor to the start of the page and start typing. When the mark appears again on the screen, you'll know it's time to print out that page and start another. Don't forget to delete your mark, or the printer will print it.

Mrs. Dolores L. Gibbons
Moosic, PA

EASY SCRIPT TRICKERY 1—The documentation doesn't mention that Easy Script supports joystick panning in both Edit and Output to Video modes. During Edit mode, the joystick gives full wraparound—left, right, up and down, with good speed. In the Output to Video mode, there is smooth scrolling left, with right wraparound. The fire button advances the text line by line, and can be held down for rapid motion. It all makes reading the output a sit-back-and-relax situation.

Some joysticks may induce a crash, but can be plugged in after the program has loaded. I use a track ball in port #2, without any problems at all.

Colin Johanson
Niddrie, Australia

EASY SCRIPT TRICKERY 2—I use Easy Script with Card/? + G, a Centronics parallel printer interface with graphics, connected to an Okidata Microline 92 printer. The Easy Script documentation gives incorrect instructions for using this sort of setup, and I went through three long-distance calls to learn these things:

Before loading Easy Script, do the following, in Direct mode, or your printer may print garbage.

```
OPEN4,4,24 : CMD4 : PRINT
"LOCK" : PRINT#4 : CLOSE4
```

After Easy Script is loaded, select option 4 for the type of printer. You'll then be asked to designate either Serial, Centronics or RS-232. Though the manual says to choose C for Centronics, you must choose S instead, since your printer is actually connected to your serial port.

Mary Brigito
Old Forge, NY

EASY SCRIPT MUSIC 1—Working with Easy Script, I have learned to appreciate more and more the power of this program. It even plays music! To hear it, go into Command mode by pressing the f1 key. Once in the Command mode, hold down the CTRL key while you press the 3 key. Incredible!

Steven Cavener
Oklahoma City, OK

EASY SCRIPT MUSIC 2—My way of hearing this program's built-in entertainment is to type the escape sequence f1 [up arrow key], then f1 [CTRL English pound sign]. I found this while experimenting with escape codes on my non-Commodore printer.

Bob Wood
St. Petersburg, FL

HAMTEXT WORD PROCESSOR—If you have the Hamtext software package, you can use it as a quick word processor capable of handling 3572 bytes on the unexpanded VIC-20.

Bring up the system, select the P option and set the TX-holding buffer to 0. Select F in the program options (edit-holding buffer), then type in any text you want, using Hamtext's editing features as much or as little as you'd like. When you're ready to print, use the G program option (save-holding buffer), and at the prompt, type P:[return].

After a little practice, you can set margins, insert or delete words, save your text to tape or disk and so on. A full page of text can be easily produced, with hundreds of free bytes remaining.

R.T. Dieckhaus
Millington, TN

QUICK BROWN FOX TIP—QBF's Move command requires you to remember or record three separate pieces of information: the Start From, End With and Put After words from your own text. I save memory (human, not computer) by inserting key material in these three places in text. I mark the starting point with ssss, the end with eeee and the insertion point with iiii. I never forget which one goes where, and it makes the Move command very easy to use. After I've moved the text, I use QBF's editing features to delete the ssss, eeee and iiii.

Robert D. Clifton
Orangeburg, SC

SIMPLE SIMON WORD PROCESSOR—There are many occasions to write directly on the video screen for non-computing purposes. An example would be generating title screens as part of a videotape sequence.

To avoid getting the annoying error messages when entering this material, just shift the return key when you press it. The cursor will move to the start of the next line with no error message.

If you have the Simon's Basic cartridge, you can use this technique to set up the world's simplest word processor, actually a screen-based typewriter. Just put the desired copy onto the screen, using shifted return as appropriate, then type the Simon's Basic command HRDCPY [return] to get the screen out to your printer.

D.L. Jassby
Princeton, NJ

SIMON'S BASIC TIP—If you have Simon's Basic, you can freeze a program listing by pressing and holding the Commodore key. Releasing it allows the listing to continue.

Joe Zeldenrust
Lansing, IL

VIC TYPEWRITER HINT—Commodore's Home Calculation cassette package includes a popular word processor that allows backward movement only one line at a time. Trying to back up to material on a previous page is time consuming at best, and maddeningly frustrating at worst.

But there *is* a tricky way to get back to any text line number you desire. Just exit the program using the stop and restore keys, then type L = n [RETURN], where n is twenty less than the line you want to see at the top of your screen. Then type GOTO 43 [RETURN] to reenter the program without losing your text.

Howard M. Mesick
Hartly, DE

VIC COMMERCIAL GAMES—Here are some things I've discovered about certain popular VIC-20 games:

Omega Race by Commodore. Press shift lock and start the game with the F1 key; the computer will start with five ships instead of three.

ALPINER! by MGH Software. The CTRL key slows down the game, and the shifted Commodore key makes your player disappear.

Money Wars by Commodore. Pressing F1 while turning on the computer causes the graphics to be different from normal.

Exterminator by Nufekop. The shift-lock key gives you repeat-fire capability.

Paratrooper from Protecto Enterprizes. Simultaneously pressing the run/stop and restore keys will reset the game.

Mark Hadland
Bayfield, WI

WORDMANAGER TIP—If you use Data 20's Z-80 Video Pak, with its WordManager program, here's a good way to do envelopes. First type the address at the middle tab, then print the envelope. To start the letter itself, use the Insert Text function to move the address down, left-justify it, then add the date.

Patrick M. Reily
New Orleans, LA

WORDPRO TIP—I use WordPro 3 Plus/64. When I want to move through the text fast, I press the CTRL key and use my cursor up and down controls. The CTRL key must be pressed each time fast scrolling is desired. The L = on the status line does not change until the CTRL key is released.

Michael C. Vawter
Takoma Park, MD

WORD PROCESSING TIP 1—With floppy disks selling for $2 or so, it doesn't cost much to keep long-term records of your word processing files. And since retyping a file can take lots of time and energy, it doesn't make sense to take *any* chances of having to retype. So, *never* erase a word processing disk until it has sat, unused, for at least a year or more.

Whenever a disk fills up, put it aside in some safe archive, for easy access. If you raid your archives for disks, you're asking for disaster. You never know when you'll need those old files for some important project. Only after a long inactive period is it safe to think of erasing, and even then you should be reluctant to act quickly.

D. Christensen
Peterborough, NH

WORD PROCESSING TIP 2—If your word processor lacks a command to jump to the end of the text file, you're not really missing much. Just use its search facilities to find "xxxxx" or some other never-used string. Most programs, after searching for the string in vain, will leave the cursor at the very end of text.

Susan Owens
Pittsburgh, PA

PROGRAMS, SELF-CONTAINED

BURROW—This "one-line special" is an antiquity—from the far-off days of 1978, when an 8K Commodore PET cost $795, and readable documentation was unheard of. There weren't any books, and the only magazines were newsletters produced by amateurs.

The PET Gazette was one of them, and here is one of its early offerings, called "BURROW":

```
1A$ = ''[up][down][left][right]'':PRINT
MID$(A$,RND(.5)*4 + 1,1)''*[left]'';:
FORI = 1TO30: NEXT:PRINT''[rvs on]
[space][left]'';:GOTO1
```

It fits on one 48-column line, and it *does* get exciting.

L.F.S.

BURROW, MK II—C-64 owners who enjoyed BURROW, our very first trick, will like this one. Put a joystick in control port 2, then run the program. Don't use the button. Do press the color keys.

```
1 GETK$:PRINT“[space][crsr
  lf]”K$MID$(“[crsr rt][crsr dn]
  [crsr up][2 crsr rt][3 rvs on][crsr lf]
  [crsr dn][crsr up][2 crsr lf][4 rvs on]
  [crsr dn][crsr up][3 rvs on]”,2*PEEK
  (56320) – 233,2)“*[crsr lf]”;:
  GOTO1
```

Carl Onsgard
Green Bay, WI

SCROLLING STARS—A nice scrolling effect for graphics or games can be achieved by the following short program:

```
10  A = RND(1)*23
20  PRINT SPC(A)“*”
30  FOR T = 1 TO 40:NEXT
40  GOTO 10
```

The time delay in line 30 can be changed to produce a different speed. For the C-64, change the 23 in line 10 to a 40.

Geoffrey Muehlberger
Atlanta, GA

MORE SCROLLING STARS—The previous trick can be done as a one-liner:

```
10  FOR I = 1 TO 66:A = RND(1)*23:
    PRINT SPC(A)“*”:FOR T = 1 TO 40:
    NEXT T,I
```

In this version, the 66 controls the number of stars printed; you can change it to any number you'd like.

Matthew C. Perry
Newport, RI

COLORED SCROLLING STARS—You can easily add color to the nice display in the More Scrolling Stars trick by entering the following line.

```
1  N = (RND(1)*16) + 1:B$ = MID$
   (“-see text-”,N,1):PRINTSPC(N)B$
   “*”;:GOTO1
```

To get the material inside the B$ quotes, hold down the CTRL key, then press each key from 1–8; release CTRL, press the Commodore key, then again press each key from 1–8. VIC owners should change the 16 to an 8, and should type only the CTRL characters inside the quotes.

Clair Farrell
Dartmouth, Nova Scotia
Canada

ONE-LINE WALLPAPER STORE—255 lovely patterns to choose from, in the privacy of your own home. This version is for the C-64; for the VIC, change the 1040 to 528, and leave out the unique C-64 colors. For either machine, you can change the length and makeup of A$, giving an entirely new selection of patterns.

```
1 A$ = “[wht][red][cyn][pur][grn][blu]
  [yel][gray 1][brown][blk]”:N = N + 1:
  FORJ = 1TO1040:R = JANDN:?MID$
  (A$,R + 1,1)”[RVS on][space]”;:
  NEXT:GOTO1
```

Marion Maddocks
Glenwood, IA

SINFUL ONE-LINER—Run the following and function as a transcendental meditator.

```
10  POKE 646,RND(0)*8:PRINTTAB(SIN
    (X)*8 + 10)“[RVS on][4 space]”:
    X = X + 0.3:GOTO10
```

It's better on the C-64 if you change both 8s to 16s, change the 10 to an 18 and add an extra space after the RVS.

David Lonard
Edinburg, TX

AMAZING ONE-LINER—Here is one of the best one-liners I have ever seen. It works on the VIC and C-64, drawing a continuous maze that is very interesting.

```
8 PRINT CHR$(205.5 + RND(8)); :
  GOTO 8
```

To get random colors on the C-64, add CHR$(149 + RND(8)*11) just before the semicolon.

Dan A. Krueger
Cary, IL

EAGLE—This works on any Commodore computer, including the oldest PETs. Use the color keys and the cursor keys. If you have a VIC, use 200 instead of 150 in the For. . .Next loop.

```
1 GETK$:PRINT“[3 CRSR LF][3 spaces]
  [3 CRSR LF]”K$MID$(“[SHFT
  U][SHFTW][SHFT I][SHFT J][SHFT W]
  [SHFT K]”,X + 1,3);:X = 3 – X:FORD =
  1TO150:NEXT:GOTO1
```

Carl Onsgard
Green Bay, WI

MILLIONAIRE'S ONE-LINER—In Canada and the northern United States, there's a craze for a lottery called 6/49. Approximately four months ago, the grand prize was $14,000,000. Many groups were formed to buy as many combinations as possible.

The following one-liner prints six random numbers from 1 to 49. You run the program for as many times as you must, to choose groups of six figures. Sometimes, the random choice gives two similar numbers; you just ignore this choice and ask for a new one by typing RUN.

```
10 FORX = 1TO6:PRINTINT(49*RND
   (1)) + 1,:NEXT
```

Jean-Pierre Thivierge
St. Bruno, Quebec

AUTOMATIC LINE DELETER—When you must delete a block of lines from your Basic program, you'd like to have a delete option, but unfortunately this is not available on Commodore computers. The task may be performed by the following one-liner. Be sure to enter it exactly as listed here, because it has some unusual constructions.

```
1  ?“{SHFT CLR}{3 CRSR DN}”F:
   ?“F = “F + 1”:L = “L”:IF F< = L
   THEN1{HOME}”:POKE198,2:
   POKE631,13:POKE632,13:END
```

Add the line to your main program, then in Direct mode enter:

```
F = [first line #]:L = [last line #]:GOTO 1
```

For example, F = 100:T = 150:GOTO 1 will delete all lines in the range of 100–150 inclusive. The program runs on the VIC, the C-64 and many PETs.

Carlo Borreo
Imperia, Italy

ONE-LINE FLASHER—This program makes any TV set or color monitor flash like a strobe light. The strobe time can be changed by changing the number in the timing loop, and the program can flash in any desired color by changing the number of the color in the second Poke. The program below is for the VIC.

```
1  A = 36879:POKEA,8:FORT = 1TO99:
   NEXT:POKEA,25:GOTO 1
```

This line is for the C-64:

```
1 A = 53280:B = A + 1:POKEA,0:POKE
  B,0:FORT = 1TO99:NEXT:POKEA,1:
  POKEB,1:GOTO 1
```

Luis Enrique Grijalva Raudales
Tijuana, Mexico

ONE-LINE CALENDAR—The following subroutine provides a perpetual lunar and solar calendar for any year from 4712 BC into the distant future.

```
5 Q = Y + (M<3):J = INT(275*M/
  9) – INT((7*Q + 7)/4) + 367*Y + D –
  INT((INT(Q/100) + 1)*3/4):RETURN
```

J is the number of days from December 1, 2 BC, up until your specified year, month, date (Y,M,D). The value of J is useful for finding the number of days between any two arbitrary dates. You may also find the day of the week for any date by calling the subroutine in this way:

```
1 INPUT‘‘Y,M,D’’;Y,M,D:GOSUB
  5:PRINT‘‘J = ‘‘J’’DAY = ’’J – 4 – 7
  *INT((J – 4)/7)
4 END
```

The days of the week start with DAY = 0 for Sunday, DAY = 1 for Monday, and so on. You can also get the phase of the moon by using:

```
2 P = J/29.530588 + .2: PRINT
  ‘‘PHASE = ’’P – INT(P):RUN
```

The moon's PHASE = 0.25 for first quarter, 0.5 for full moon, 0.75 for third quarter and 1.0 or 0.0 for new moon. If you run the above lines for the 4th of July, 1776 (Y,M,D = 1776,7,4), you will find that it was a Thursday (DAY = 4) and the moon was just past full (PHASE = 0.58).

For an in-depth look at this subject, consult the Astronomical Computing column in *Sky & Telescope* for May 1984.

E.J. Schmal
Bowie, MD

C-64 DISK COMMANDS—

New Disk (format)	OPEN15,8,15, ‘‘N0:name,ID#’’ CLOSE15
Save and Replace	SAVE‘‘@0:name’’,8
Verify	VERIFY‘‘name’’,8 or ‘‘*’’
Load	LOAD‘‘name’’,8
List Directory	LOAD‘‘$’’,8 then LIST
Initialize	OPEN15,8,15 PRINT#15,‘‘I’’ CLOSE15
Scratch	OPEN15,8,15, ‘‘s0:name’’ CLOSE15
Validate	OPEN15,8,15 PRINT#15,‘‘V’’ CLOSE15
Rename	OPEN15,8,15 PRINT#15, ‘‘R0:newname = :old name’’ CLOSE15
Copy	OPEN15,8,15 PRINT#15, ‘‘c0:new = 0:oldfile’’ CLOSE15

Mary D. Brigito
Old Forge, NY

ONE-LINE NUMBER GAME—This program will choose a number between 0 and 100, and will give you ten chances to guess it. If your guess is too low, the screen will show a *less than* sign (<); if your guess is too high, the screen will display a *greater than* sign (>). Guess the right answer, and the computer will display an *equals* sign.

```
5 C = INT = (RND(0)*100):FORT = 0TO9:
  INPUTA:B = SGN(A – C):PRINT
  CHR$(B + 61):IFB< >0THENNEXT
```

Robert Lavsevic
Address Unknown

PRINTER TRICK—Because I am working with the monitor and machine language, I wrote this triple-loop program to make a one-page hex and decimal conversion chart. If you start the chart at the very top of a page, it just fills the sheet. The program works perfectly with my Commodore 4022 tractor printer and should work the same with others.

```
1 OPEN4,4:CMD4:FORI = 0TO63:FOR
  J = 1TO255STEP64:D$ = STR$
  (J):PRINTJSPC(5 – LEN(D$))
2 H = J/16:FORK = 1TO2:H% = H:
  H$ = CHR$(48 + H% – (H% >9)*7):
  PRINTH$;:H = 16*(H – H%)
3 NEXT:PRINTSPC(12);:NEXT:PRINT:
  NEXT:PRINT#4:CLOSE4
```

G. Sturdivant
Address Unknown

C-64 ONE-LINERS—The accompanying listing includes five different C-64 programs submitted by our readers. We have listed them all together, with numerous REMs, but you can easily separate them.

Computer Sounds meets the one-line criterion, but you must abbreviate *every* possible keyword in order to fit it in. The

```
1 REM ** COMPUTER SOUNDS **
2 REM{4 SPACEs}YOU MUST USE
  EVERY POSSIBLE{13 SPACEs}K
  EYWORD ABBREVIATION, AND
3 REM{4 SPACEs}TURN VOLUME T
  O MAXIMUM!
4 REM{4 SPACEs}HO LAM, NEW Y
  ORK, NY
5 S=54272:P{SHFT O}S+4,17:F{
  SHFT O}I=0TO1:J=INT(R{SHFT
   N}(1)*99):P{SHFT O}S+I,J:
  P{SHFT O}S+I+5,J:N{SHFT E}
  :P{SHFT O}S+24,15:G{SHFT O
  }5

9 REM
90 REM ** ALPHABET POKER #1
    **
91 REM{4 SPACEs}CLEAR SCREEN
   , THEN RUN.
92 REM{4 SPACEs}LAMAR MCLOUT
   H, DAVISON, MI
93 REM
95 A=RND(0)*26+1:POKE1030+A+
   40*12,A:POKE55302+A+40*12
   ,14:FORI=1TO150:NEXT:G{SH
   FT O}95

99 REM
100 REM ** ALPHABET POKER #2
     **
102 REM{4 SPACEs}CLEAR SCREE
    N, THEN RUN.
104 REM{4 SPACEs}LAMAR MCLOU
    TH, DAVISON, MI
106 REM

150 POKE53281,0:A=RND(0)*26+
    1:B=RND(0)*998+1024:POKE
    B,A:POKEB+54272,A:GOTO15
    0
199 REM
200 REM ** SQUARES **
202 REM{4 SPACEs}LINE 240 IM
    PROVES THE COLOR.
204 REM{4 SPACEs}GLENN ZUCH,
     N. TONAWANDA, NY
206 REM
240 POKE53280,6:POKE53281,6:
    PRINT"{SHFT CLR}{CTRL 8}
    ":FORI=1TO19:PRINT:NEXT
250 PRINTMID$("{CRSR UP}{CRS
    R DN}{CRSR LF}{CRSR RT}"
    ,RND(.9)*3+1,1)" {CRSR L
    F}";:FORI=1TO50:NEXT:PRI
    NT"{CTRL 9}{CRSR RT}{CRS
    R LF}{CRSR RT}";:GOTO250
299 REM
300 REM ** SKYLINE **
302 REM{4 SPACEs}LINE 340 1M
    PROVES THE COLOR.
304 REM{4 SPACEs}GLENN ZUCH,
     N. TONAWANDA, NY
306 REM
340 POKE53280,12:POKE53281,1
    2:PRINT"{SHFT CLR}{CTRL
    1}":FORI=1TO19:PRINT:NEX
    T
350 PRINTMID$("{CRSR UP}{CRS
    R DN}{CRSR LF}{CRSR RT}"
    ,RND(.5)*4+1,1)" {CRSR L
    F}";:FORI=1TO50:NEXT:PRI
    NT"{CTRL 9}{2 SPACEs}{CR
    SR LF}";:GOTO350
```

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abbreviations are in Appendix D of your user's guide. When you run the program, be sure your monitor's volume control is turned up to maximum.

The Alphabet Pokers give some interesting screen displays. Clearing the screen before running them gives the best effect, but of course it takes a second line. Tch, tch!

Skyline and Squares also can run as one-liners, but the extra lines give a nicer presentation.

L.F.S.

Flagrant Patriotism—Enter this one-liner:

```
1 PRINT “{2 spaces}{CTRL R}
  {CTRL 1}{11 spaces}{CTRL 8}
  {12 spaces}{CTRL 3}{11 spaces}”:
  POKE 53280,1:POKE53281,1:GOTO1
```

Now run the program, count to ten and press the stop key. Then use your cursor controls and the space bar to wipe out the Break and Ready messages. Press [CTRL 2] and see the flag of Belgium. Anyone for the Union Jack?

R. Rock
Montgomery, AL

Video Voodoo—This C-64 one-liner creates a bizarre display, which is especially effective on a color TV or monitor. The real action takes place in a ten-byte machine language routine, which is poked into memory at 828 decimal ($033C hex) by the Basic program. Type it in, run it and observe some psychedelic magic.

```
1 FORX = 0TO9:READA:POKE828 +
  X,A:NEXT:DATA120,206,33,208,
  206,33,208,76,61,3:SYS828
```

You can regain control of your machine by simultaneously pressing the run/stop and restore keys. Here's an assembly listing of the program:

```
033C  78              SEI
033D  CE   21   D0    DEC   $D021
0340  CE   21   D0    DEC   $D021
0343  4C   3D   03    JMP   $033D
```

Bruce Graves, Jr.
Chelmsford, MA

Machine Language Lesson—Many readers are totally in the dark when it comes to machine language. It may shed a little light if we explain the various sections of the assembly listing in the trick directly above.

- Each line in the listing describes a single machine language instruction.
- The first column indicates the memory location, in hexadecimal format, of the first byte in the instruction.
- The next three columns show, in hex, the byte or bytes that make up the instruction. A complete instruction can be one, two or three bytes in length.
- The final columns show the mnemonic representation of the instruction.

In the first line of the sample program, you can see that memory location $033C holds a $78, and that the $78 is the hex form of a SEI instruction. (SEI sets the interrupt mask. You don't have to know any machine language to see the value of the mnemonic.)

Louis F. Sander
Pittsburgh, PA

Amusing Your Friends—Non-computerists who come to see my VIC always expect me to program to their specifications with just a few taps of the keys. So I always look for programs that are simple to type, yet impressive to use, to satisfy my visitors until their interest is genuinely aroused.

Here's a two-line program that turns my VIC into a rudimentary organ. It gets people's attention, so I can take them step-by-step into more time-consuming programming techniques. After I arouse their initial interest with this little trick, visitors never complain about the time it takes to write a program:

```
1 POKE 36878,15 : A = PEEK(197) : IF
  A = 64 THEN 1
2 POKE 36876,A + 170 : GOTO 1
```

To use the organ, just press any key. Stop/restore turns off the sound when you no longer want to hear it.

Tony Giordano
Brooklyn, NY

VIC One-Liner—Run it, then press some keys.

```
100 POKE 36879,PEEK(197) OR 8 :
    GOTO 100
```

Walter Orange
Hollywood, CA

Design with Sound—VIC one-liner:

```
10 PRINTCHR$(204.5 + RND(1));:X =
   INT(RND(1)*120) + 135:POKE
   36878,15:POKE36875,X:GOTO10
```

Chris Blair
Staten Island, NY

Dynamic Design—VIC one-liner:

```
1 POKE 36879,PEEK(36879)AND247:
  PRINT“[CLR]”:FORI = 1TO99:
  POKE RND(1)*506 + 38400,RND
  (1)*10:
  NEXT
```

I. Firkusny
New York, NY

Word Trick—Here is a program to tutor computer users in Pig Latin. It translates English to Swine, and after very little practice, most students should have little trouble with Ig-pay Atin-lay. Study hard, because a second language always looks impressive on a job application!

```
10 PRINT “{SHFT CLR}”
20 A$ = “SWHAT” : PRINT
30 INPUT “ENGLISH”;A$
40 B$ = RIGHT$(A$,LEN(A$) – 1) :
   A$ = “ – ” + LEFT$(A$,1) + “AY”
50 PRINT : PRINT“{2 spaces}
   SWINE:” ;B$;A$
60 GOTO 20
```

Gary Forney
Oelwein, IA

Solomon's Basic—Problem: three kids, one computer, all want to use it. Solution:

```
10 PRINT “WAIT WHILE I CHOOSE”
20 FOR I = 1 TO 5000 : NEXT
30 INT(X = 3*RND(0) + 1)
40 IF X = 1 THEN PRINT “ALICIA IS
   FIRST” : END
50 IF X = 2 THEN PRINT “KEN IS
   FIRST” : END
60 IF X = 3 THEN PRINT “SARAH IS
   FIRST” : END
```

Nick Long
Carey, OH

Binary One-Liner—This lists the binary number sequence from 0000 to 1111 using nested loops. The number of loops can be changed for the required number of bits, which may increase the number of program lines. The program is:

```
10 FORA = 0TO1:FORB = 0TO1:
   FORC = 0TO1:FORD = 0TO1:PRINTA;
   B;C;D:NEXT:NEXT:NEXT:NEXT
```

Lee G. Halphen
Opelousas, LA

VIC TONE GENERATOR—Here's a little machine language program that beeps every time a key is pressed. It's written to run in the cassette buffer, so it shouldn't interfere with your Basic program at all. Once the program is Poked into memory, SYS828 will start it, and pressing the stop and restore keys will disable it.

```
60000 FOR A = 828 TO 861 : READ B :
   POKE A,B : NEXT
60010 DATA 169, 15, 141, 14, 144, 120,
   169, 78, 141, 20
60020 DATA 3, 169, 3, 141, 21, 3, 88,
   96, 165, 197
60030 DATA 201, 128, 240, 7, 101, 197,
   105, 128, 141, 12
60040 DATA 144, 76, 191, 234
```

Trevor J. Crawford
Hanover, Ontario
Canada

SCREEN DISPLAY & GRAPHICS

SCREEN LAYOUT AID—Having trouble laying out your graphics on the screen, or designing a sprite that looks like what you want it to? Try taping a piece of waxed paper or tracing paper in front of your monitor, and drawing directly on it what you want to reproduce graphically. You can still see through the paper, and can position your characters behind the lines you've drawn.

Bruce Jaeger
St. Paul, MN

SCREEN DRAWING TIP—Screen mapping is much easier when you photocopy the map in your manual (or make your own) and place it under glass in a photo frame or under desk glass. Laminating it between pieces of clear self-adhesive plastic works well, too. Use a china marker and a paper-towel “eraser” for a reusable map.

Lorraine Richards-May
Leesburg, IN

PRINT @ 1—You can position the cursor anywhere on the screen by using a routine like this:

```
10  X$ = “[39 CRSR RTs]”:Y$ =
   “[24 CRSR DNs]
100  X = 20:Y = 10:GOSUB 3000
110  PRINT “SORCERY”
2999  END
3000  REM ** POSITION CURSOR **
3010  PRINT “[HOME]”LEFT$(X$,X)
  LEFT$(Y$,Y);:RETURN
```

Variables X$ and Y$ should be set up early in the program and never changed. The code in line 100 establishes the desired cursor position, then calls the subroutine in 3000, which positions the cursor on column X and line Y. (X = 0 for the leftmost column, Y = 0 for the topmost line.) On return from the subroutine, line 110 prints the desired material at that position. Line 2999 prevents unwanted execution of the subroutine.

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PRINT @ 2—Once you understand the technique in the PRINT @ 1 trick, you can shorten things by eliminating line 10 and changing line 3010 to read:

```
3010 PRINT “[HOME]”LEFT$(“
[24 CRSR DNs]”,Y)TAB(X);:RETURN
```

Kathleen Mead
Westerville, OH

PRINT @ 3—The above seems a cumbersome way to print at any position on the screen. The following one line can be added anywhere in your program.

```
POKE214,12:PRINT:POKE
211,10:PRINT“RUN MAGAZINE”
```

In the above line, POKE 214 sets the line number and POKE 211 sets the column number.

You can use any line or column numbers to print where you'd like or to go back up on the screen and print in data. It doesn't seem to work without the Print statement between the two Pokes.

Unsigned
Parsippany, NJ

PRINT @ 4—To place the cursor anywhere on the screen without using the Print statement, use:

```
10  POKE 781,X : REM X POSITION
20  POKE 782,Y : REM Y POSITION
30  POKE 783,0: SYS 65520
40  PRINT “message”
```

This works with the VIC and C-64. The leftmost screen column is X position 0, and the top screen line is Y position 0.

A variation on the above lets you use a single number to specify the X,Y screen position. The home position is 0, the next is 1, and so on up to the end of the screen. The lower right-hand screen position is 461 for the VIC, or 999 for the C-64. Here's the code that will do it for the VIC:

```
100  P = 250 : GOSUB 1000 : PRINT
     “message” : REM P = POSITION
999  END
1000  POKE 781,P/22 : POKE782,P – 22*
  PEEK (781) : POKE 783,0 : SYS 65520 :
  RETURN
```

For the C-64, the subroutine is the following:

```
1000  POKE 781,P/40 : POKE782,P – 40*
  PEEK(781) : POKE 783,0 : SYS 65520 :
  RETURN
```

Marcia D. Lakes
Rowland Heights, CA

CENTERED PRINTING—Centering lines of text between the left and right edges of the screen can be time-consuming, especially if you want to center more than a few lines. You can let the computer do the work for you by using the following subroutine. For a VIC, use 22 instead of 40 in line 1010.

```
100  A$ = “CENTER”:GOSUB1010
120  A$ = “THIS”:GOSUB1010
130  A$ = “MATERIAL, PLEASE”:
     GOSUB1010
140  END
1000  REM ** CENTERING
  SUBROUTINE **
1010  PRINTTAB((40 – LEN(A$))/
  2)A$:RETURN
```

Works like a charm.

Michael Berry
Kewanee, IL

CURSOR MAGIC—To find where the cursor lives at any time, use the following subroutine.

```
20  POKE 783,PEEK(783) OR1:
    SYS65520:R = PEEK(781):C = PEEK
    (782):RETURN
```

R is the row and C is the column of the cursor's present location, with the first position of each being numbered 0.

To position the cursor to any row or column, enter:

```
30  POKE781,R:POKE782,C:
    POKE783,PEEK(783)AND254:
    SYS 65520:RETURN
```

Set R and C, then GOSUB30.

Barry G. Adams
Fredericton, New Brunswick

Tab Improved—An alternate Tab function is POKE 211,X (where X is the column between 0 and 39 as in the standard Tab function). The standard function works well as long as you are tabbing from left to right, but it lacks the ability to move from right to left. POKE 211,X will tab either right or left on any line, and it's particularly useful if you want to tab backwards to a previous field.

Jeffrey W. Mitchell
Stony Brook, NY

Print Hint—When a single program line contains two or more Print statements, there's a nifty way to combine them. You can put a shifted return inside your Print statement. When you reach the point where you want to print on a new screen line, type your closing quotation mark, then delete it. Then press [CTRL RVS ON], the shifted letter M and [CTRL RVS OFF], then type whatever you want to appear on the next screen line. Listing the line so created will give strange results, so correct all your mistakes before entering it into your program.

Greg McMahan
Cincinnati, OH

Two-Column Printing—It's not always desirable to print two columns of data as the computer would most naturally do it; that is, printing across the screen, jumping from one column to the other. The following routine prints one column at a time, from the top down.

```
10 PRINT ''[SHFT CLEAR]'' : X = 1
20 PRINT ''[HOME]''; : IF X<0
   THENCL = 20 : REM MAKE CL = 11
   FOR VIC
30 FOR L = 1 TO 20 : N = N + 1
   : PRINT TAB(CL);N;TAB
   (CL + 4)''TRICKY'' : NEXT
40 X = -X : CL = 0 : IF X<0 THEN 20
```

The number of lines in each column is controlled by the initial value of CL, as set in line 20. The routine may be looped through as many times as you'd like, just by clearing the screen and avoiding line 10 on all succeeding loops.

A. Peck, Jr.
Cincinnati, OH

Resetting Screen Links—If you've ever drawn fancy boxes or displays that extend to the edge of your screen, you've noticed that it seems impossible to print inside that box or display. The reason is that the operating system remembers which line overlapped the 40-column screen and prevents the normal Print statements from putting anything on that line. It's frustrating!

The easy solution is to reset the screen links once the initial fancy graphics are printed. Call the following subroutine, and you'll be able to print anything on any line.

```
1010 FOR Q = 217 TO 242
1020IF PEEK(Q)<128 THEN POKE Q,
  PEEK(Q) + 128
1030 NEXT:RETURN
```

The above Basic routine works well but is somewhat slow. If you want to speed things up, use the following machine language version. After running the Basic loader, you can call the relinker at any time by entering SYS 830.

```
1000 FOR J = 830 TO 843:READA:
  POKEJ,A:NEXT
1010 DATA 162,0,181,217,9,128,149
1020 DATA 217,232.224,25,208,245,96
```

Bruce Jaeger
St. Paul, MN

Screen Poke Hint—When you assign variables to the screen position of a character, and use the common

```
S = X + [screen width] * Y
```

the X and Y take 14 bytes of memory, and the math slows down the computer.

Instead, use only one variable, for example, S. Add or subtract one to move horizontally, and add or subtract (screen width) to move vertically. It's faster, and it can save needed memory in a small VIC. The screen width is, of course, 22 in a VIC and 40 in a C-64.

Timothy C. Shea
Burlington, VT

Screen Pokes Simplified—The numbers used here are for the Commodore 64, but the idea is applicable to the VIC-20 as well.

When writing a program that uses graphics Poked to the screen, you normally Poke the screen memory location with the character code and then Poke the color memory location with the color code.

For instance, the following program lines put a white ball in the upper left-hand corner of the screen and a red ball in the lower right-hand corner.

```
50 POKE 1024,81:POKE 55296,1
60 POKE 2023,81:POKE 56295,2
```

This process requires you to calculate both the screen and color memory locations.

To make this programming task simpler, at the beginning of each program I set a variable equal to the difference between color memory and screen memory (54272). This difference is the same for any screen location. The following example gives the same result as above.

```
10 CO = 54272
50 POKE 1024,81:POKE 1024 + CO,1
60 POKE 2023,81:POKE 2023 + CO,2
```

Here you must only deal with the screen memory map and can totally forget about the color memory map.

54272 is also the start of the C-64's sound locations, so this variable can be used in music routines as well.

Barbara H. Schulak
Iowa City, IA

Finding Screen Poke Values—If you need to find the screen Poke value of any character, here's a simple way. Hit the CLR/HOME key, either shifted or unshifted, and type in the character. Move the cursor down a row and type this:

```
PRINT PEEK(1024) (for the C-64) or
PRINT PEEK(7680) (for the unexpanded
VIC) or
PRINT PEEK(4096) (for the expanded
VIC)
```

Hit the return key and the Poke number will be printed. What you're doing here is printing the character in the first screen position, then Peeking that memory location to read its contents.

W.M. Shockley
Riverside, CA

Universal Screen Pokes—The VIC's screen can appear at one of two locations, depending on the amount of memory installed. The following simple trick will allow your screen Pokes to work with any VIC, whether expanded or not.

```
SC = PEEK(648)*256:EX = PEEK(44) =
18:CM = 30720 – 3072*EX + SC
```

To place characters on the screen, use:

```
POKE SC + (offset),(character code)
```

To assign colors, use:

```
POKE CM + (offset),(color code)
```

By adding this to the program line, the C-64 will be included:

```
:IF PEEK(808) = 237 THEN CM = 55296
```

Frank Colosimo
Rochester, NY

MNUMBER MNEMONIC—When Poking to the C-64 screen, you usually Poke color memory as well. If you remember that the C-64's SID chip starts at memory location 54272, you need not memorize the starting location of color memory, which is 1024 locations higher, and you need not calculate any offsets to this start.

Just add 54272 to whatever screen location you're Poking, then Poke the desired color there. For example, POKE 1600,1 will put an A in the approximate center of your screen. If it's not visible because its color is the same as the screen color, you can change its color to white by entering:

```
POKE 1600 + 54272,1
```

Robert A. Adler
Montreal, Quebec

COLOR POKES—It's easy to remember the Poke values for the first eight VIC/C-64 colors—the Poke is one less than the number on the color's key. BLK is on the 1 key, so its Poke is 0; WHT is on the 2 key, so its Poke is 1, and so on.

Margaret Ittel
Los Angeles, CA

SETTING COLOR MEMORY—To set the C-64's color memory to a particular color, you may see something like this being done:

```
POKE53281,X:PRINT“{SHFT CLR}”:
FORI = 55296TO56295:
POKEI,Y:NEXT
```

where X is the screen color and Y is the desired color for Poked characters.

But when you clear the screen, the computer resets all of color memory to the current screen color. With this in mind, the following routine will give the same result as the one above.

```
POKE53281,Y : PRINT“{SHFT CLR}” :
POKE53281,X
```

Color memory will be set to Y, and the blank screen will be the color X. This routine takes about four jiffies on the C-64, saving several seconds over the other method.

You'll notice a little flicker when the screen is cleared, and if it bothers you, there's a simple way around it. Just turn off the display before initializing color memory, using:

```
POKE 53265,PEEK(53265) AND NOT 16
```

Later turn it back on with this line:

```
POKE 53265,PEEK(53265) OR 16
```

The result will be a fast, invisible setup of every location in color memory.

Michael McGuire
Gardner, KS

CHARACTER COLORS—On the VIC and C-64, memory location 646 holds the color code of the current character color, and you can change the character color by Poking 646. Under most conditions it is easier to change it by printing a color control character such as CTRL 3, but there are times when POKE 646 is better. For example, when you want to print in random colors, you can do this:

```
100 POKE 646,RND(0)*8
110 PRINT “MULTICOLOR”,
120 FOR I = 1 TO 200 : NEXT
130 GOTO 100
```

Line 100 randomly sets the character color, as running the program will prove. C-64 owners can change the 8 in that line to a 16 to take advantage of the C-64's eight additional colors. VIC-20 owners making that change will see something quite unexpected.

L.F.S.

INVISIBLE CURSOR—The following line will make your C-64 cursor invisible, independent of any colors previously set. It turns the cursor the same color as the screen background.

```
POKE 646,PEEK(53281)
```

Manfred Klocek
Moodus, CT

REVERSE FIELD HINT—When working on a program that uses reversed lettering, you don't have to use the CTRL 9 reverse field symbol inside quotes to enable the Reverse Field mode. POKE 199,1 will cause the subsequent printing to be in reverse field. POKE 199,0 will undo the reverse, as will printing a return.

Paul James
Cleveland, TN

EASY VIC COLORS—The following function will let you choose the VIC's screen/border combination with great ease. The format is close to that of a real graphics command.

```
10 DEF FNC(V) = V*16 – 8
20 SCREEN = 36879
30 POKE SCREEN,FNC(SN) + BD
```

SN is a screen color from 1–16 and BD is a border color from 0–7. Here are the color codes:

SCREEN COLORS

1 BLACK
2 WHITE
3 RED
4 CYAN
5 PURPLE
6 GREEN
7 BLUE
8 YELLOW
9 ORANGE
10 LT. ORANGE
11 PINK
12 LT. CYAN
13 LT. PURPLE
14 LT. GREEN
15 LT. BLUE
16 LT. YELLOW

BORDER COLORS

0 BLACK
1 WHITE
2 RED
3 CYAN
4 PURPLE
5 GREEN
6 BLUE
7 YELLOW

Kelly R. Foster
Address Unknown

PRINTING NUMBERS—When the computer prints a positive number, it always prints a leading space (where the sign would be if the number were negative), and a trailing space (to set the number off from whatever is printed next). If this is annoying in your application, use

```
N$ = MID$(STR$(N),2)
```

Where N is the number, N$ will be its string equivalent, less the extra spaces. To put the spaces back in, use N = VAL(N$).

Don Saito, Jr.
Torrance, CA

Lining Up Numbers—There are many ways to format numbers, which in the noncomputer world are always lined up according to the position of their decimal points, but which computers love to left-justify. The following is a simple program to align the decimal points in numbers containing from one to three digits:

```
10  FOR I=9 TO 109 STEP 50
20  PRINT SPC(ABS(I<100)) SPC(ABS
    (I<10)) I
30  NEXT I
```

This is useful when printing highly variable numbers to a particular screen location and, of course, when printing out columns of numbers.

Roy E. Kannaday, Jr.
Littleton, CO

Buck Writing 1—On many occasions I have wanted to print dollars and cents, rounded to the nearest cent, with two decimal places. The following one line, added to a program, does it, except for negative numbers:

```
10  V=INT((V+.005)*100):
    V=(V+.1)/100:V$=STR$(V):
    V$=LEFT$(V$,LEN(V$)-1)
```

where V = the original value and V$ = the string representation of the value.

When you print the variable V$, any value of V will be printed with two decimal places, rounded to the nearest cent value.

Alfred G. Swenson
Renton, WA

Buck Writing 2—This one handles negative numbers, but fails on items less than a dime.

```
20  V=INT(V*100 + .001):
    V$=STR$(V):V$=“$”+LEFT$
    (V$,LEN(V$)-2)“.”+RIGHT$(V$,2)
```

To print the output in a neat column, use:

```
Q=LEN(V$):PRINT TAB(20-Q)V$
```

The 20 in this line is the position of the last character in V$.

Marilyn Sallee
Alliance, NE

Buck Writing 3—This one handles everything; with four times as many lines, it *should.*

```
100  IF X<.005 AND X>-.005 THEN
     X$=“$ 0.00”:GOTO 140
110  X=X + .005*SGN(X):X$=STR$(X)
120  FOR I=1 TO LEN(X$):IF MID$
     (X$,I,1)=“.”THEN
     X$=“$”+LEFT$(X$,I+2):
     GOTO 140
130  NEXT:X$=“$”+X$+“.00”:
     GOTO 140
140  PRINT X$
```

Kevin O'Connor
Union, NJ

Undocumented Characters—There are four graphics characters that slipped through the cracks in Commodore's documentation. They aren't inscribed on the keyboard, nor are they listed on the CHR$ charts in the manuals, but they *do* appear on some of the screen Poke charts.

They can be accessed only when in Upper-/Lowercase mode (which you can get by pressing the Commodore and shift keys simultaneously). Besides being able to type the appropriate key, you can Poke their value or print a CHR$ code. Here they are.

CHR$

Name	**Keys**	**Poke**	**Value**
Checkerboard	Shift Pi	94	126 or 222
Herringbone 1	Comd *	95	127 or 223
Herringbone 2	Shift Lb.	105	169 or 233
Check mark	Shift @	122	186 or 250

Strictly Commodore
Calgary, Alberta
Canada

Custom Character Trick—When using custom characters on the VIC, you can also use the regular characters at will, just by printing their reversed versions. To prove it, type in POKE 36869,255 to get into Custom Character mode.

As you subsequently press keys, you'll see whatever random RAM patterns make up your pseudo-custom characters. Now press {CTRL 9} to put the VIC into Reverse mode, and notice that the keys print their normal characters.

Joseph Chan
Barrington, RI

Custom Characters Tip—In custom character generator programs, the cursor often disappears when the program is run. If you want to change numbers in the Data statements, you have to do it blind. A partial solution is to change the color of the cursor. It won't show up on the blank spaces, but you'll see the cursor where there are characters on the screen.

Mark Lucas
Farmington Hills, MI

VIC Special Characters 1—There are many unusual graphics characters inside your VIC, just waiting for you to find them. The following program will give you some idea of their nature.

```
10 PRINT “[SHIFT CLR]” : POKE
   36879,93 : A=7680 : C=30720
20 FOR E=8 TO 15
30 POKE A,42 : POKE A+C,E :
   A=A+44
40 NEXT E
50 PRINT “[14 CRSR DNS]”
```

The characters that this program produces are not available by direct keyboard entry, yet they are very simple to access. And it doesn't end there. The 42 in line 30 can be changed to many other values for still other characters. (Try 81 or 87, for example.) The screen/border combination in line 10 was chosen to make the characters easy to see on my black and white monitor, but the program works with any combination.

It is interesting to note that these characters appear only when you use color codes 8–15. It is also interesting to note that many of the characters are multicolored.

Alan Rumsey
Sydney, Australia

VIC Special Characters 2—This little program will turn all the characters upside down. Or is it downside up? The cursor won't be visible, but it's still there.

```
10 POKE 52,28 : POKE 56,28 : CLR
20 FOR Y=7168 TO 7679 STEP 8
30 FOR X=0 TO 7 : POKE Y+7-X,
   PEEK(Y+X+25600) : NEXT X,Y
40 POKE 36869,255
```

To return things to normal, simultaneously press the run/stop and restore keys.

Pat Cole
Jacksonville, FL

Son of BURROW—For an amazing surprise on your C-64 or VIC, try entering POKE 214,30 while in Direct mode. Then hold down the CRSR DN key and watch what happens. Don't worry, the screen will return to normal after you've held the key down for a while.

David D. Panzer
Ft. Knox, KY

TV Typewriter—On the VIC and C-64, a Direct mode POKE 120,0 turns the computer into a mindless printing machine. Characters typed on the keyboard will be repeated on the screen, but not accepted as input to the computer. You can't run, load, save, undo the Poke, or *anything*, until the computer is reset. All keys work properly, including color and cursor controls, but the stop/restore key combination has no effect.

Quyen N. Truong
Address Unknown

TV Typewriter II—Here's another way to do the same thing on the VIC:

```
10 SYS 58959 : PRINT “{CRSR
   UP}”CHR$(13) : GOTO 10
```

Run the program and you're in TV typewriter mode. In this case, the stop/restore key combination will get you out of the program.

Matt Cisternino
Ontario, CA

Slow Printing—To have your computer print letters individually at a slow rate of speed, type the following:

```
10  A$ = “your message here”:
    GOSUB1000
999  END
1000  FOR A = 1 TO LEN(A$):PRINT
    MID$(A$,A,1);:FOR B = 1 TO
    40:NEXTB,A:RETURN
```

To print at different speeds, just change the high value of B in the For. . .Next loop.

Chris Brellochs
Ithaca, NY

Color Spectacular—Run this program and you'll see your C-64 do something with color you never thought could be done. The effect is impossible to describe and must be seen to be believed.

The following program is shown in Basic, so it can be easily typed in. When you run it, it Pokes in a small machine language program, which does the actual work. For those who know about such things, the ML is completely relocatable. For the others, just use it as is and enjoy it.

```
10  FOR A = 49152 TO 49163 : READ B :
    POKE A,B : NEXT : SYS 49152
20  DATA 238,32,208,162,0,232,224,14,
    208,251,240,244
```

Dimitri Korahais
Great Neck, NY

C-64 Cursor Speed—POKE 56325,SP will speed up or slow down the cursor, if SP is any number from 0–255. The lower the number, the faster the cursor will move. The normal value is 58.

Don Saito, Jr.
Torrance, CA

C-64 Sideways Screen Scroll—This works, and it is slick. Under some conditions, resetting the screen links will make it even slicker. Put something on the screen, then run:

```
100  FOR I = 1 TO 40 : PRINT“{HOME}
     {CRSR RT}”;:FOR J = 1 TO 24:
     PRINT“”{CRSR LF}{3 SHFT INST}
     {DEL}{CRSR DN}
     {CRSR RT}”;:NEXTJ,I
```

The strange sequence after the second Print statement is required to properly control the Quote mode; it must be performed *exactly* as shown, and if you hit the wrong key, you must start all over. After your keyboard magic is done, the line will list differently than it was typed, and it *cannot* be edited.

Eric the Juggler
Pittsburgh, PA

Screen Blanking—To slightly speed up your C-64, you can make the screen turn blank when it is not needed. When the screen turns blank, it appears to be the same color as the border. To do this, enter:

```
POKE 53265,PEEK(53265) AND 239
```

To return it to normal, enter:

```
POKE 53265,PEEK(53265) OR 16
```

Pressing the stop and restore keys will also return the screen to normal. While the screen is blank, it can still be written to, but the writing will be invisible. The timesaving while the screen is blank can vary from almost nothing to over ten percent, so it's worth considering whenever time is a factor.

Mark Mankins
Malvern, OH

C-64 Screen Sorcery—On the C-64 only, a single screen line can be erased by entering:

```
POKE781,LN : SYS59903
```

(where LN is the line number you wish to erase, from 0–24). You can put this code in a subroutine and use a For...Next loop to clear any group of lines you wish.

Miraculously, it's also easy to copy one line of the screen into another line. If MF is the number of the screen line your text is to be moved from, and MT is the number it's to be moved to, you can move it with:

```
POKE781,MT:SYS59888:POKE172,
PEEK(60656 + MF):POKE780,PEEK
(216 + MF):SYS59848
```

And finally, to scroll the screen up one line, simply use SYS59626.

Barry G. Adams
Fredericton, New Brunswick
Canada

Special Effects Dept.—This C-64 audiovisual effect works well with any program not using memory locations 49152–49215. It can't be easily described, but you won't regret typing it into your machine. To use it in a Basic program, run lines 10–50 one time. Then, whenever you want the effect, just type SYS49152.

```
10 FOR BF = 49152 TO 49215:READ MH:
   POKE BF,MH:NEXT
20 DATA162,0,160,0,173,32,208,141,64,
   192,173,33,208,141,65,192,169,0,
   105,15,201
30 DATA15,240,3,169,0,234,141,24,212,
   140,32,208,140,33,208,200,
   192,96,208,242
```

```
40 DATA232,224,70,208,228,173,64,
    192,141,32,208,173,65,192,141,
    33,208,169,0
50 DATA141,24,212,96
```

Brendan J. Frey
Calgary, Alberta
Canada

VIC Curiosity—On the VIC-20, if you Poke into location 36866, graphics symbols and colors appear on the screen. For starters, type in:

```
POKE 36866,10
```

After this, you can Poke numbers up to 100 or so, and get interesting patterns on the screen. To get out of this mode, use run/stop and restore keys.

Jason Issendorf
Brandon, SD

VIC Cursor and List Speeds—Poking 25 into location 37879 drastically increases the speed at which the VIC's cursor moves around the screen. Poking a value lower than about 20 speeds it up incredibly. Poking a zero causes the screen to scroll slowly while listing a program; the shift-lock key slows it even further and the CTRL key stops the listing for as long as you press it.

Matt Cisternino
Ontario, CA

VIC Scrolling—The following line will make the entire VIC screen scroll downward, being replaced by the background color.

```
100  FORI=25TO130:POKE36881,
     I:NEXT
```

This line will scroll it back up again:

```
200  FORI=130TO25STEP-1:
     POKE 36881,I:NEXT
```

While the screen is down (out of sight), you can clear it and/or print onto it, and the resultant copy will be on the screen as it scrolls back up. Presto-change-o!

Rob Jacob
Jones, MI

VIC Screen Scraper—

```
1 FORG=5TO55:POKE36864,G:POKE
36865,G+G:FORF=1TO65: NEXTF,G:
POKE36864,5:POKE36865,25
```

Ramey Bell
Fall City, WA

VIC Downward Scrolling—To scroll the VIC-20's screen downward, enter the following.

```
PRINT"{HOME}{CRSR DN}
{CRSR LF}{INSERT}":POKE 218,158
```

Each time it's executed, the entire screen, *except the top line*, scrolls downward one line.

Of course, the technique is best used in Program mode. You can execute the trick code as many times as you want, scrolling down one more line each time. Here's an elegant example of the trick in use.

```
10  PRINT "{SHFT CLR}"
20  PRINT "THE LADDER OF
SUCCESS"
30  FOR I = 1 TO 20 : PRINT "{HOME}
    {CRSR DN}{CRSR LF}{INSERT}"
    :POKE 218,158 : NEXT
40  FOR I = 1 TO 20 : PRINT : NEXT :
    FOR I = 1 TO 20 : PRINT : FOR J = 1
    TO 200 : NEXT J,I
50  GOTO 10
```

This trick also works on the C-64, but with bugs. Can anyone figure out a bug-free version?

Harold J. Wallace, Jr.
Macclenny, FL

VIC Screen Crawl—This routine works on any VIC, and it's useful when you make important announcements. Your message will be printed at the very bottom of the screen and will scroll slowly toward the top. You can vary the speed of the scroll by changing the 45 in line 20.

```
10 POKE 36879,8 : PRINT "your
   message here"
20 FOR A = 131 TO 0 STEP  - 1 : POKE
   36865,A : FOR B = 1 TO 45 : NEXT :
   NEXT : POKE 36865,24
```

Since the routine will change your screen and border colors, you may want to add a command at the end to return them to their former values.

Rick Wyman
Hampden, MA

VIC Earthquakes—These ideas make excellent subroutines for games where, for instance, the spaceship crash-lands. They make the entire screen shake, as though an earthquake is occurring beneath the computer. The first routine shakes the screen horizontally, while the second one shakes it vertically.

```
10 REM HORIZONTAL SHAKER
20 FOR Y = 1 TO 20 : FOR X = 3 TO 7 :
   POKE 36864,X : NEXT X,Y : POKE
   36864,5
30 REM VERTICAL SHAKER
40 FOR Y = 1 TO 20 : FOR X = 23TO27 :
   POKE 36865,X : NEXT X,Y : POKE
   36865,25
```

Jon Ares
Oregon City, OR

VIC Tornado—On the VIC, there's an interesting way to display titles, directions or scene changes during a game. Try the following short program.

```
10 A = 36864
20 FOR X = 46 TO 0 STEP  - 2 :
   POKE B,X : POKE A,51 - X
30 FOR T = 1 TO 5 : NEXT : NEXT
40 FOR C = 1 TO 20 : PRINT
   "MAGIC MAGIC MAGIC" : NEXT
50 FOR X = 0 TO 46 STEP 2 : POKE
   B,X : POKE A,51 - X
60 FOR T = 1 TO 5 : NEXT : NEXT
```

A good way to use the tornado is to call lines 20 and 50 as subroutines, generating your screen display between the appropriate GOSUBs.

Stephen Hite
Metairie, LA

SOUND & MUSIC

Music Sources—As we experiment with the musical capabilities of our computers, most of us quickly run out of melodies. Here are some excellent, readily available sources of two- and three-part songs: music textbooks used in fifth- through eighth-grade school classes; music for two or three recorders (the wooden flute-like kind, not a cassette player. Ed.); SAB (soprano, alto, bass) *a capella* choir music.

The music to the songs in these books sounds nice on the computer. The books are easier to work with than most commercial sheet music, because they're written for the proper number of voices.

Elizabeth Oman
Pharr, TX

Audio Hint—If you program late at night, like I do, and you use sound in your programs, you run the risk of disturbing others in the house. The answer to the problem is to use earphones instead of a speaker, and sometimes this is easier than you might think.

On the Commodore monitors, the front and rear panel audio jacks are connected internally, without going through the front/rear input switch. You can plug an 8-ohm headphone into whichever jack you're not using, turn the volume to its lowest position and work to your heart's content. If your headphone doesn't have a plug to fit the monitor jack, and most of them don't, Radio Shack and most electronics stores can sell you an adapter.

Harry Metz
New York, NY

SOUND ADVICE—If you're having trouble getting just the right sound for games and such, try using two or more voices together. Doing this can make interesting sound effects.

Dan Halbert
New Port Richey, FL

SOUND SUGGESTION—When working on sound effects, use the List statement at the end of your subroutine. For example:

```
100 REM SOUND SUBROUTINE
110 POKE xxxxx,xx
120 POKE yyyyy,yy
130 etc.
140 etc.
200 LIST 100-200
```

When you type RUN100, you'll hear your work, then see it scroll up on the screen, making it a breeze to change any values. When you get your sound effect the way you want it, replace the List line with a return.

James F. Walker
Gladwin, MI

C-64 BUZZER—It's easy to signal an incorrect user response by jogging the volume control on and off with:

```
10 FORA = 1TO20:POKE54296,15:
FORT = 1TO3:NEXT:POKE54296,0:
FORT = 1TO3:NEXT:NEXT
```

James G. Cooper
New Albany, IN

BACKWARD 64 SOUND—If you use a 1701/1702 monitor with a 5-pin DIN to 4-RCA cable plugged into the back of it, one of the RCA plugs is dangling free. You can use it as an audio *input* to your computer.

By using a patch cord to connect it to a radio or recorder output jack, and typing POKE 54296,15 (max. volume), you can play the radio through the 1701/1702's speaker, under computer control! The computer can filter and control the volume of the radio sound.

To be safe, you should consult p. 472 of the *Commodore Programmer's Reference Guide*, to find the acceptable characteristics of the signal you want to send to EXT IN.

David H. Kornhauser
Honolulu, HI

A NICE SOUND—This one-liner will produce the sound of a silver bell on your C-64.

```
10  S = 54272 : POKE S + 24,15 :
    POKE S + 1,110 : POKE S + 5,9 :
    POKE S + 6,9 : POKE
    S + 4,17 : POKE S + 4,16
```

Albert H. Coya
Miami, FL

BETTER-SOUNDING SOUND—If your C-64 music is a bit out of rhythm, and if you can do without the screen display while the music is playing, there's an easy way to improve things. Just turn off the screen by adding the following line to your program, before the music starts.

```
POKE 53265,PEEK(53265) AND 239
```

To turn the screen back on, add this:

```
POKE 53265,PEEK(53265) OR 16
```

Disabling the screen relieves the computer of having to update it, which is normally done during and between notes. The result is more perfect rhythm, but a side effect is that the music speeds up a bit. If this is bothersome, you can adjust your timing loops accordingly.

Tom Jeffries
Oakland, CA

SOUND FILTER—Page 88 of *The Commodore 64 User's Guide* shows a neat little program that lets you play songs by entering the appropriate note values into Data statements. If you find that the song contains static or is excessively noisy as each note is played back, try adding the following line after clearing the sound registers.

```
3  POKE 54295,4
```

This activates bit 4 of the resonance filter, which will weed out the noise, leaving you with a clean, pure tone. (If you don't understand the technical terms, put the line in anyway—the computer will know what to do! Ed.)

Lionel Sapkus
Burbank, IL

SILENCER—When creating sound programs on the C-64, it's not uncommon for the sounds to continue, at a low level, after they ought to have finished. To avoid this, just enter POKE 54296,0 after each sound, then enter POKE 54296,15 when you're ready for it to start again. The Pokes turn your computer's volume control from minimum to maximum, respectively.

Dan Schikore
Florissant, MO

DE-CLICKER—When working with C-64 sound, are you annoyed by the clicks and thuds when the sounds are turned off? Below is a machine language subroutine that banishes them by gently resetting the SID registers.

Running these lines once gets the machine language into memory, where you can use it as many times as you want. At the end of each sound effect, just call the routine with a SYS 50000, and say good-bye to clicks.

```
1000  FOR X = 50000 TO 50018
1010  READ A : POKE X,A
1020  NEXT X
1030  DATA 169,0,133,253,169,212,133,
  254
1040  DATA 160,0,152,145,253,200,
  192,24
1050  DATA 208,249,96
```

Bruce Jaeger
St. Paul, MN

VIC DULCET TONES—Have you been dissatisfied with the poor tonal quality of music programs you've written for your VIC-20? It's impossible to get pitches completely in tune on the VIC, but the key of G major comes closest, so try writing your music in that key. If G major puts you in the wrong range for singing the tune, transpose your music to C major—it next best approximates the well-tempered scale to which we're accustomed.

Elizabeth Oman
Pharr, TX

MISCELLANEOUS

User's Group Hint—If you're looking for a place to hold meetings, look into local shopping malls. Many malls have rooms for public functions, and the rent can be very reasonable. When we've met at malls, the families have really loved it. Wives and children can shop and browse while Daddy's at the meeting. Malls are also easy-to-find, non-threatening environments, making things that much easier for new computerists.

Pittsburgh Area Computer Club
Pittsburgh, PA

Sight-Saving Tip—If computing leaves you with tired eyes and fuzzy vision, give thought to having your eyesight checked. I had those problems, but because I've always had keen eyesight, I never thought of glasses. Beginning a major project, with the prospect of spending weeks at the screen, was the motivation I needed to see an optometrist. In less than an hour, with no pain or discomfort, I had a prescription for glasses. I use them only for computing, and it's hard to believe how much better I can see the screen. The eye exam costs less than a good game cartridge, and much of it was done on a computerized auto-refractor.

Louis F. Sander
Pittsburgh, PA

Bytes—A byte is the elementary unit of computer storage, and can be thought of as equivalent to one character. A kilobyte, or K, is 2^{10} bytes, or 1024 bytes. A megabyte is 1024K, or 1,048,576 bytes.

There are about 2000 characters on a double-spaced typewritten sheet of paper, so we could store all the information on such a page in about 2K bytes of memory. One floppy disk in a Commodore 1541 drive can hold about 175K bytes, or the equivalent of about 88 double-spaced typewritten sheets of paper. Many hard disk drives can hold 10 megabytes of information, or about twice as much text as in the King James Version of the Bible.

Computer Kindergarten
Pittsburgh, PA

Operating Tip—Write any numbers you use repeatedly on a wee piece of masking tape and stick them to the top of your keyboard. (Now let's see. . .is it SYS49152 or SYS49512? Let me consult my wee tape!)

Marian Hatch
Las Lunas, NM

Useful Boxes—Those soft plastic boxes used to store and mail cassettes have hundreds of other uses. They are perfect for storing resistors and other small electronic parts, as well as nails, screws, stamps, small desk items and so on. You can put one in your pocket and carry it anywhere with little fear of it opening up or breaking.

J. Besoin-d'Argent
Paris, France

Overseas Computing—Many computerists who contemplate foreign travel become needlessly concerned about the 220-volt current and their 110-volt computers. In West Germany and Italy, it is easy to purchase a 300-watt, 220-110V stepdown transformer for about $25. For many years I have run computers and associated equipment from such a transformer, and have had no problems. My transformer currently handles a VIC, 1541 disk, MPS-801 printer and a Panasonic portable TV, again with no difficulties.

If you bring a U.S. TV overseas and use it only with your computer, you will have no trouble, providing you use a stepdown transformer. Trying to use it for TV reception will give a picture but no sound. Most European TVs will work with a U.S. VIC, but will not reproduce sound. The same is true for U.S. TVs used with European VICs.

William J. Dirks
Somewhere in Germany

Pen Pals—Being overseas has its good and bad points. The good is access to both British and American software for my C-64, and the bad is not having access to many Commodore stores.

Regardless, I've devised a way to keep in touch with my home in the States. I hook my C-64 to my video cassette recorder, then type a video letter to my friend in New Jersey, demonstrating the latest game from the British press or whatever strikes my fancy.

When he's been thoroughly amazed by British ingenuity, my friend rerecords the tape with American TV programs and mails it back. Then I can see what is happening in the States, watch 60 Minutes or a movie from HBO.

Bill Murray
Alconbury, England

The Final Trick—Well, there you have it—512, or 2^9 (1000000000 in binary), useful hints and tips from the magic world of Commodore computing. No matter what your computer interests, we'll bet our last floppy disk that you've found more than one trick here that will make your computing experience more enjoyable and useful.

Wizard Lou Sander has conjured up perhaps his greatest feat of prestidigitation in presenting this magic collection.

On the following pages, we have included an index of the tricks published in this issue. You'll find them organized by topic and according to page number, for easy reference.

Now, for our final trick, watch us disappear. . . .

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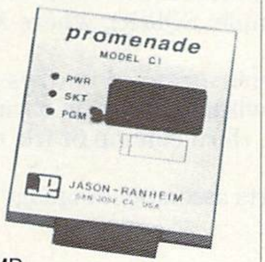

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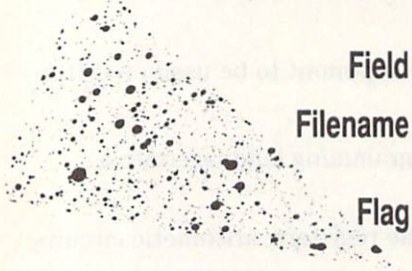
A Commodore Glossary

By MIKE APSEY

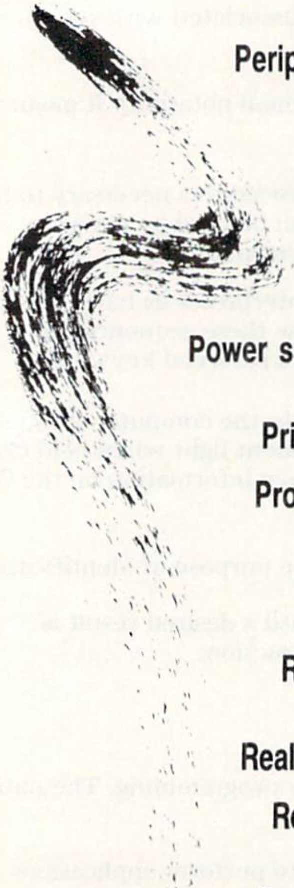
ASCII	Acronym for American Standard Code for Information Interchange. A standardized binary code given to alphanumeric characters.
Access time	The time needed to get data from memory or from a storage device such as a disk or tape.
Accumulator	A temporary storage register within the Central Processing Unit that receives the result of a computation.
Address	A numerical representation of a location within memory. A 64K computer contains 64 × 1024, or 65536, addresses.
Alphanumeric	A character set made up of letters and numbers.
Application program	A computer program written to meet a user's specific need. Example: a spreadsheet program.
Argument	A variable whose value affects the value of a function or operation to which it belongs. Example: SQR(X), where X is the argument.
Array	A list or table of elements arranged in rows and/or columns. Elements are identified by location within the array. Example: A(1,3) would be positioned in the first row, third column of the table named A.
Assembler	A program that converts assembly language instructions into machine language instructions.
Assembly language	A language composed of mnemonics that translates directly into a machine's native language, which is composed of numbers.
Asterisk	The star character (*). Used in most computers to represent the multiplication function: 4*4 = 16.
Backup	Copying your files or programs onto tape or disk for safekeeping just in case your originals get damaged.
BASIC	Acronym for Beginners All-purpose Symbolic Instruction Code. A high-level computer language. Helps computers speak English to the operator.
Baud	A unit of speed associated with transmission of bits of data over the telephone lines. Common baud rates are 110, 300, 1200, 2400 and 9600.
Binary	A number system (based on the powers of 2) using the digits 0 and 1 to represent off (0) or on (1) conditions.
Bit	Acronym for Binary digIT, which can have the value of 0 or 1. It is the smallest unit of data used by a computer.

Buffer	A temporary holding tank for data being transferred between devices.
Bug	A mistake made in the design of a program.
Bus	A circuit that transmits data or power between different devices or locations.
Byte	A collection of eight binary digits needed to form an ASCII character. This is the smallest division of memory accessible as a unit by the computer.
Character	A letter (A–Z), digit (0–9) or special symbol used to represent a piece of data.
Checksum	A value representing the sum of all bytes in a program.
Chip	Slang for multi-pin integrated circuit device.
CHR$	The character representation of an ASCII value. CHR$(65) is the letter A.
Clock	Internal counting device that can be used for program timing, time-of-day computation programs.
Column	Generally, a vertical screen row. Counterpart of the horizontal row, which is referred to as ROW.
Command	Usually a reserved word recognized by the system and causing some predefined action to be taken when entered.
Compatibility	The ability of an instruction, program or component to be used on different computers.
Compiler	A program that translates a high-level programming language into a machine language program.
CPU	Central Processing Unit that contains all the registers, arithmetic circuits, logic boards and operating language.
CRT	A picture tube on which images and characters are displayed. Similar to a television screen.
Crunch	Slang for performing computations. Also used to describe the process of trimming the fat from programs by combining program functions to streamline execution.
Cursor	Name given to the prompt character showing the screen position at which the next entry will appear.
Daisywheel	A print head that forms letter-quality, full characters rather than characters formed from dots.
Data	Any information stored or manipulated by a computer. Facts, numbers, letters and symbols stored in the computer and given a particular meaning.
Database	A collection of data available to the computer that is needed to perform a specific task. A data file might be composed of names, addresses and phone numbers of a particular group of people.
Debug	To find an error in a program and to correct it.
Device	A collective term used to describe a piece of computer hardware. Any of several peripheral attachments like cassette recorders, disk drives, printers or modems.
Dimension	Used to describe the parameters of an array. Must be used if the array will contain more than 11 elements.

Direct mode	Used to describe computer operations that are not under program control. Sometimes called the READY status.
Directory	A file that lists the names and length of all the programs or files stored on a disk.
Disk	Used to describe the magnetic storage media and hardware devices which read and record data. A floppy disk is a round, thin piece of plastic upon and into which microscopic flecks of magnetic particles have been attached. This disk is then encased in a sturdy square jacket and the data it contains read through a slot as it whirls past a read/write head. *Disk drive* is the name given to the hardware device that spins the disk, and reads or writes data to and from it.
DOS	Disk Operating System. A collection of programs stored on a disk that controls the execution of all other programs on disk.
Dot matrix	Term used to describe a printer that prints characters using dots of ink rather than fully filled characters.
Editing	The act of building, changing or correcting a program in memory.
Error	The name given to any identifiable program request for which no (or faulty) logic exists.
Expansion port	The connection on the rear of the computer into which various additional memory and/or programs may be inserted.
Field	Specified categories of information within a record in a database file.
Filename	A name assigned to a file. Without it, the computer cannot maintain a catalog of different files and would be confused.
Flag	A character or bit that indicates a special condition such as the end of word or list of data entries.
Floating point	A method of representing numbers, whether positive, negative, decimal, fraction or exponential (raised to a power).
Function	A defined set of instructions recognized by Basic and causing a predetermined sequence of mathematical operations to be performed on the target number. ABS, INT, SQR, etc., are all Basic functions.
Graphics	Word used to describe characters other than alphanumeric. Also used to describe pictures or other screen displays.
Greater than	Basic mathematical condition. Represented by the sign >. Useful programming tool.
Hard copy	A printed copy of computer output on paper.
Hardware	The physical equipment that makes up a computer system.
Hex	Short for hexadecimal. A method of counting whereby 16 numbers (and letters) exist before a carry to the next column to the left. In hex, the number 11 represents 17 decimal. This system allows 256 numbers to be represented with just two digit places (FF) if zero is included as a number.
Hi-res	Short for high resolution. A method of generating or illuminating the individual dots on the screen in a custom fashion rather than with a keystroke. Allows representing giant or tiny letters, numbers and pictures on screen.
IEEE	Acronym for a standard and predictable method of transferring data between computer and hardware attachments. Established by the Institute of Electrical and Electronics Engineers.



Immediate	Used to describe computer status. *Immediate* and *direct* are used interchangeably as terms to describe a computer not under the program control mode of operation.
Indexing	Used in machine language programming to describe address-change locations.
Instruction	A command that tells the computer what operation to perform next.
Interface	A term for any device that connects two hardware elements. Also the act of connecting them.
Interpreter	Any program instruction set designed to link the desires of the user with the native language of the system. A Basic interpreter allows the computer to effectively translate the user's commands into a machine-understandable instruction.
Interrupt	A signal that causes a program to halt in order to process something else, yet saving the current routine so that it can be resumed later.
I/O	Slang for Input/Output and used to describe system elements whose function is to both send and receive data.
IRQ	Abbreviation for Interrupt ReQuest. A line available to machine language programmers that is checked as the processor cycles. It is used for keyboard scanning and system-clock updates and can be used to cause the system to look elsewhere for data.
Jump table	A pre-defined list of addresses—used by the Kernal—to which program execution is diverted to accomplish certain tasks associated with system operation.
K	An abbreviation for the prefix kilo (1000 in decimal notation). It means 1024 when applied to computers.
Kernal	Name used to describe a jump table of useful procedures necessary to the system operation of Commodore computers. Can be used by machine-language programmers to accomplish various system tasks.
Keyword	A sequence of letters recognized by the Basic Interpreter as having a predefined function. Care must be used not to allow these sequences to appear in variable names. For example, RUN is a reserved keyword.
Light pen	A photosensitive pen-like device that connects to the computer through a game port. It can detect the presence of fluorescent light when held close to a display screen. It can draw, point to, or move information on the CRT screen.
Line number	The number which begins a program line for the purpose of identification.
Loop	A series of instructions executed repeatedly until a desired result is achieved. For. . .Next is a common looping instruction.
Machine code	A machine language program.
Machine Language (M/L)	The binary and hexadecimal roots of computer programming. The native language of the microprocessing devices.
Mainframe	A large computer that provides the capability to perform applications requiring huge amounts of data.
Matrix	A two-dimensional array. A table is considered a matrix.
Memory	The storage area in a computer where instructions for a program being executed are kept. Also see RAM and ROM.



Memory map	An address-by-address description of microprocessor architecture.
Menu	A displayed list of options from which the user selects an action to be performed. Programs providing this menu selection are said to be menu-driven.
Microprocessor	A single-chip central processing unit. The heart of a computer, designed to constantly check its own condition and status, branching appropriately as various status signals are detected.
Mnemonic	A short, easy-to-remember name or abbreviation used to form the commands of an assembly language program.
Modem	Modulator-Demodulator. A device that converts computer digital signals into sound signals, and back again in order to allow computer communication over telephone lines.
Monitor	A television-like device used for output display.
On line	The term applied when a computer is sending or receiving data over telephone lines.
Op code	Operation Code. Part of a machine language instruction that identifies the operation to be performed.
Operator	A symbol indicating a mathematical operation to be performed. For example, + is an operator that performs addition.
Output	The results generated from the processing of a mass of data. Data transferred from internal memory to a secondary, external storage device such as a printer, disk or tape.
Peripheral	Any hardware—distinct from the CPU and main memory—that may provide the system with outside storage or communication. Examples: printer and disk drive.
Pixel	Definable locations on a display screen that are used to form images on the screen.
Port	An input or output connection to a computer. A place to plug in peripherals and power supplies.
Power supply	A transistor switch and cable that converts ac power into dc power for your computer.
Printout	Hard copy.
Program	A complete, detailed list of instructions a computer must follow to solve a problem or to accomplish a task.
RAM	Acronym for Random Access Memory, the area of memory whose condition may be changed to represent program, variable or other data.
Raster	Used to describe TV tube (CRT) scan parameters. Necessary consideration in interfacing a light pen.
Real time	The actual time during which a physical process occurs.
Record	A unit of information, used in a database, composed of one or more fields of specific data.
Register	A device in which system data is held, transferred and manipulated. Includes X and Y index registers, status register, program counter and stack pointer. Used in machine language programming.
Reserved word	A series of letters or a word that is recognized by the computer's Basic interpreter to invoke certain actions.

Reset	Initiating a sequence of microprocessor events that simulate turning the computer off and back on again. On some systems, it is called a warm boot.
ROM	Read Only Memory. Microprocessor memory that can be accessed, but is unalterable.
Rows	Horizontal lines of text or data on the screen.
RS-232	A standard of computer communication and data transfer referred to as serial.
Sector	A part of a track on a disk.
Serial	Any of several methods of data transfer in which the bits composing the characters are sent one bit at a time in sequential order.
Software	All programs written for execution on hardware.
Stack	The stack is a temporary holding area within the microprocessor for information used by both the microprocessor and the programmer. It contains such temporary data as the return address while a GOSUB executes. Manipulating the stack requires machine language familiarity.
Statement	In Basic, any recognized command that is neither an I/O statement nor a function. CLR, DATA, GOTO, etc., are all statements and are recognized by the Basic interpreter.
String	The word used to describe the contents of an alphanumeric variable. ''Hello'' is the string value of the variable A$ in the case of: A$ = ''Hello''.
Subroutine	A program within a program. Subroutines are small programs—incorporated into larger ones—that relieve programmers from having to constantly repeat the same instruction sequence. When the programmer desires to execute the repeating instruction, GOSUB is used. When the program subroutine is finished and RETURN encountered, program control returns to the detour point and the program resumes.
System	Generally, the computer and all its peripherals.
Tape	A recording media for data or computer programs. Like a disk, it is used for mass storage in magnetic form.
Terminal	An input/output device used to enter data into the computer (keyboard) and record the output (printer, disk or tape).
Track	The portion of a moving storage medium, such as a disk or tape, that is accessible to a reading head.
User port	This connection at the rear of the computer is a window to the rest of the world. From this port, the computer can control an endless variety of accessories, such as modems.
Variable	This term is used somewhat loosely to refer to any value which is subject to change. As such, any string or numeric value assigned to a representative letter or letters is called a variable.
VIA	Versatile Interface Adapter. This device is an input/output device designed to accept and pass data. VIAs are responsible for checking the keyboard, joystick, paddles and peripheral user-port attachments. Since they are unbuffered, you are cautioned against plugging and unplugging accessories with the power applied.
Zero page	This refers to the first 256 memory-location addresses. Zero page typically contains information necessary to the operation of the system. To manipulate or change zero page data above the 144th location risks a system crash.

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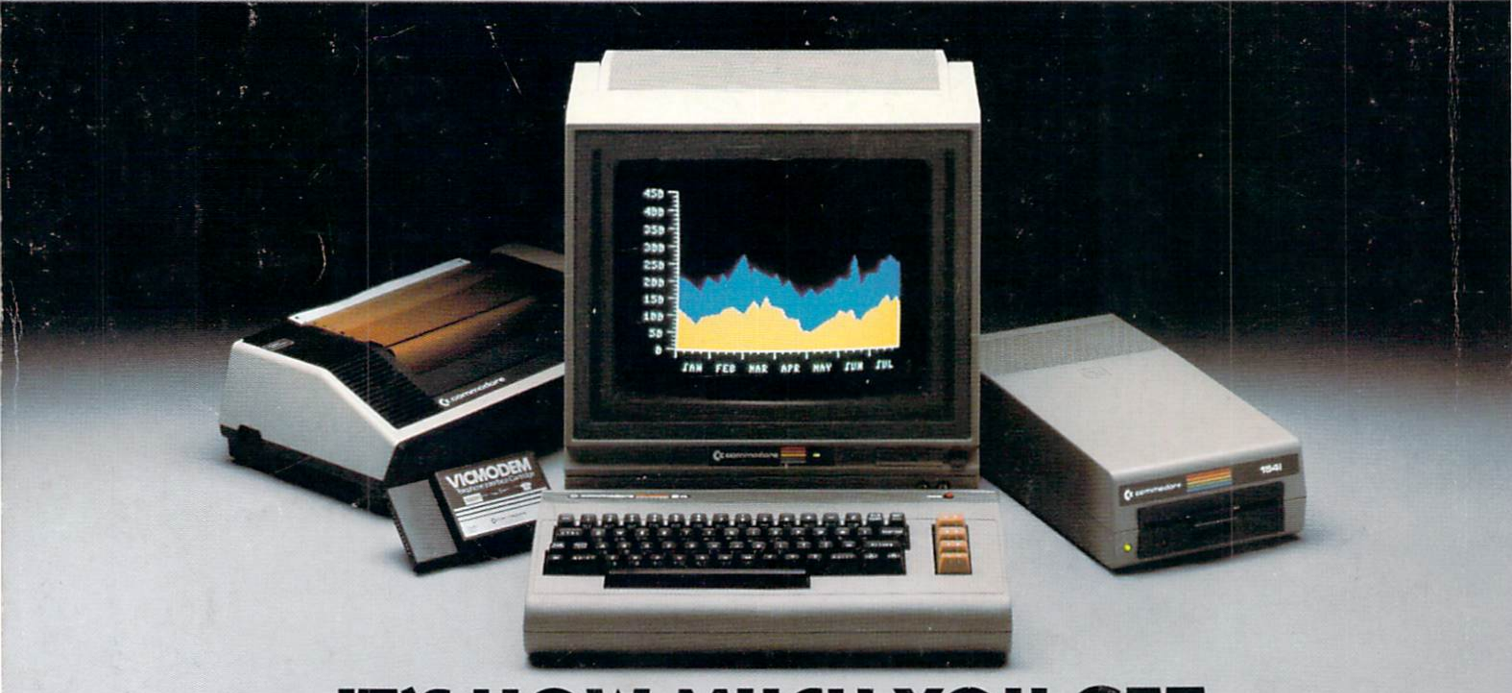

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